

User's Guide

AVAYA™ X330WAN

MULTISERVICE WAN ACCESS ROUTER MODULE

SOFTWARE VERSION 3.12

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Preface

About This Guide

This guide describes the features of the X330WAN expansion modules, as well as the X330WAN functional details. The commands specific to the X330WAN modules are listed and described in Chapter 6 of this guide, as well as included in the basic and common configuration chapters.

Objectives

The purpose of this guide is to describe the concepts used in X330WAN, and provide the necessary information to configure and manage the X330WAN modules.

Audience

This guide is intended for Avaya customers who have networking experience, and are familiar with router-based internetworking.

Conventions

The documentation for this product uses the following conventions to convey instructions and information:

Naming

For information pertaining to all of the X330WAN module types, the term X330WAN is used. For information pertaining to specific X330WAN module types, the module type is indicated.

Notes, Cautions and Warnings



Note: Notes contain helpful information, hints, or references to material in other documentation.



Caution: Cautions indicate that you should be careful when performing a certain action. The action could cause damage to the equipment or result in a loss of data.



Warning: This means physical danger. Failure to follow the instructions or warnings may result in bodily injury. You should ensure that you are qualified for this task and have read and understood all the instructions.

CLI Commands

- CLI commands for you to enter are in the **computer bold** font.
- Information displayed on screen as well as parameters of a command are displayed in `computer` font.
- Parameters that you enter are in pointed brackets `<>`.
- Alternative but mandatory keywords are grouped in braces `{}` and separated by a vertical bar `|`.
- Optional keywords are in square brackets `[]` and options are separated by a vertical bar `|`.
- If you enter an alphanumeric string of two words or more, enclose the string in quotes.

Documentation Accuracy

Every effort was made to ensure that the information in this book was complete and accurate at the time of printing. However, information is subject to change. For updated information, refer to the Release Notes supplied with this product, or at <http://www.avaya.com/support>.

General System Information

Preventing Toll Fraud

Toll fraud is the use of your telecommunications system by an unauthorized party, for example, persons other than your company's employees, agents, subcontractors, or persons working on your company's behalf. Note that there may be a risk of toll fraud associated with your telecommunications system and, if toll fraud occurs, it can result in substantial additional charges for your telecommunications services. You and your system manager are responsible for the security of your system, such as programming and configuring your equipment to prevent unauthorized use. The system manager is also responsible for reading all installation, instruction, and

system administration documents provided with this product in order to fully understand the features that can introduce risk of toll fraud and the steps that can be taken to reduce that risk. Avaya does not warrant that this product is immune from or will prevent unauthorized use of common-carrier telecommunication services or facilities accessed through or connected to it. Avaya will not be responsible for any charges that result from such unauthorized use.

If you suspect that you are being victimized by toll fraud and require assistance, contact the Toll Fraud Intervention Hotline at +1 800 643 2353 or contact your local Avaya representative.

Important Safety Information

You must read the following safety information before carrying out any installation or removal of components, or any maintenance procedures.



Caution: Avaya switches and expansion modules contain components sensitive to electrostatic discharge. Do not touch the circuit board unless instructed to do so.

This module operates under SELV (Safety Extra Low Voltage) conditions, according to IEC 950. The SELV conditions are maintained only if the equipment in which this module is installed is also operational under SELV.

Introduction

This chapter provides introductory information for the X330WAN and contains the following sections:

- **Overview** - Describes the purpose of the X330WAN series and the general characteristics of each module in the series.
- **Features** - Provides lists and short descriptions of the features for each of the modules in the X330WAN series.
- **Sample Applications** - Describes the X330WAN's most common general applications.
- **Functional Concepts Overview** - Provides a brief description of the main concepts used in designing X330WAN.
- **Avaya X330WAN Network Management** - Describes the different possibilities available for managing X330WAN.
- **Requirements and Specifications** - Provides the environmental and power specifications for the X330WAN.

Overview

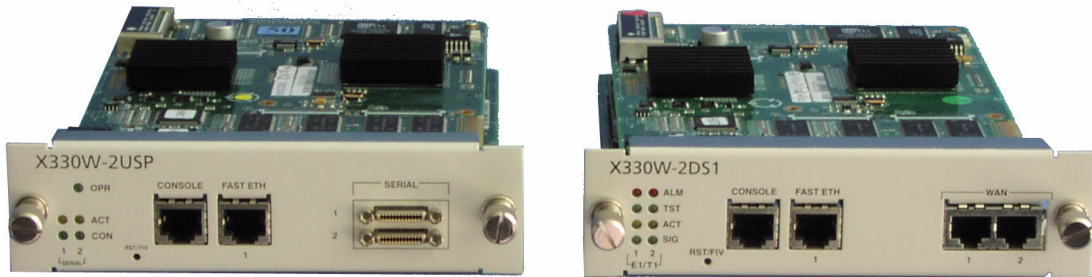
Avaya presents X330WAN, a series of WAN Edge Router expansion modules for the P330 Stackable Switching System and the Avaya G700 Media Gateway. X330WAN enables you to connect your Avaya P330 switch to a WAN. X330WAN is part of Avaya's Converged Networks Solution that includes IP telephones, data switches and IP exchanges.

The X330WAN family includes the following modules:

- X330W-2DS1 access router module has 2 E1/T1 interfaces, a single 10/100Base-T Fast Ethernet port, and a Console port.
- The X330W-2USP contains 2 USP (Universal Serial Ports), one 10/100Base-T Fast Ethernet port and one Console port.

An Avaya P330 stack can have X330WAN access router modules inserted in each of the switches in the stack with an expansion slot. A maximum stack configuration of 10 P334T switches using the X330WAN provides 490 Fast Ethernet 10/100 ports, and 20 E1/T1 or USP ports.

Figure 1.1 X330W-2USP and X330W-2DS1 Modules



Features

The following is a description of X330W-2DS1 and X330W-2USP features:

Layer 1 Features

X330W-2DS1

- 2 channelized/fractional E1/T1 ports, with RJ-48 connectors.
- 10/100Base-T Auto-Negotiation Fast Ethernet port.
- 100 Mbps, Full Duplex FabricFastEthernet interface, for internal connection to the P330 switch.
- RS-232, RJ-45 port for Console and dial-in modem connection.

X330W-2USP

- 2 USP ports with standard SCSI connectors, supporting V.35, X.21, and EIA530A protocols.
- Supports DTE serial connections up to 8 Mbps.
- 10/100Base-T Auto-Negotiation Fast Ethernet port.
- 100 Mbps, Full Duplex FabricFastEthernet interface, for internal connection to the P330 switch.
- RS-232 RJ-45 port for Console and dial-in modem connection.

Layer 2 Features

- PPP over channeled and fractional E1/T1. X330WAN has the ability to map several PPP sessions to a single E1/T1 interface.
- PPP over USP.
- Unframed E1 for enabling full 2.048 Mbps bandwidth usage.

- Point-to-Point Frame Relay encapsulation over channelized/fractional/unframed E1/T1 ports or over a USP interface.
- Frame Relay LMI types supported: ANSI (Annex D), ITU-T:Q-933 (Annex A0), LMI-Rev1, and No LMI.
- Backup functionality supported between any type of Serial Layer 2 interface. For more information refer to "Backup Interfaces" on page 44.
- Up to 253 VLANs on the FabricFastEthernet LAN interface. VLANs assigned on the FabricFastEthernet port enable the X330WAN to perform inter-VLAN routing. Specific VLANs can be configured to have access to the WAN while others can be configured to deny such access.
- Auto-Negotiation - the Fast Ethernet port supports Auto-Negotiation that automatically detects and supports the duplex mode and speed of a connected device. X330WAN can be connected to Ethernet or Fast Ethernet equipment at full or half duplex without any further configuration.

Layer 3 Features

- RIP v1/v2 routing protocols.
- Single Area OSPF routing protocol - X330WAN can be configured as an OSPF Autonomous System Boundary Router (ASBR) by configuring route redistribution. You can install X330WAN in the OSPF backbone area (area 0.0.0.0) or in any OSPF area that is part of a multiple areas network. X330WAN can not be configured to be an OSPF area border router.
- VRRP redundancy protocol - supported only on the X330WAN's LAN (Fast Ethernet and FabricFastEthernet) ports.
- Equal-Cost MultiPath (ECMP) - enables load balancing by splitting traffic between several equivalent paths.
- Enhanced routing configuration for efficient bandwidth usage, including RIP Distribution Lists. For more information, refer to "Enhanced Routing Capabilities" on page 35.

Convergence Features

- **Quality of Service (QoS)** - X330WAN supports the ability to separate traffic into 4 strict priority queues per egress serial interface. The queue assignment is performed using Policy. For more detailed information, refer to "Frame Relay Encapsulation" on page 46.
- **Guaranteed delay for VoIP traffic** - X330WAN supports VoIP Queue mode. In this mode traffic labelled as voice traffic receives preference over all other traffic. The X330WAN default VoIP queuing mode is optimized for the G.729 CODEC. For more detailed information, refer to "Frame Relay Encapsulation" on page 46.

- **Weighted Random Early Detection (WRED)** - X330WAN uses WRED on its ingress and egress queues in order to improve the performance of the network when overloaded. The purpose of WRED is to indicate to transmitting hosts to reduce their transmission speed when the ingress X330WAN queues are congested. For more detailed information, refer to "Frame Relay Encapsulation" on page 46.
- **Policy** - Each Serial interface, the Fast Ethernet port, and the FabricFastEthernet interface can have an ingress and egress active Policy list. X330WAN can enforce QoS Policy on routed packets and change their 802.1p priority, according to the packet characteristics. X330WAN allows changing the DSCP value in the IP header of a packet based on packet characteristics (DSCP coloring). In addition, X330WAN supports Access Control policies that define which packets should be forwarded or denied access to the network. For more detailed information, refer to "Policy" on page 48.
- **RTP Header Compression** - X330WAN saves up to 60% of the bandwidth necessary using RTP compression. It also enhances the efficiency of voice transmission over the network by compressing the headers of Real Time Protocol (RTP) packets, thereby minimizing the overhead and the delays involved in RTP implementation. For more detailed information, refer to "RTP Header Compression (cRTP)" on page 53.

Sample Applications

The primary uses of the X330WAN are:

- Branch Office connectivity to Headquarters.
- Small/Medium Business connectivity directly to an ISP (Internet Service Provider).

For illustrations and configuration examples of common applications, refer to Chapter 4: *Operational Concepts and Configuration Examples*.

Branch Office Connectivity to Headquarters

X330WAN enables connecting branch office LANs, based on the P330 switch, to a central office to access the corporate WAN. Each branch office in this solution is connected to the headquarters office via a leased line or Frame Relay service, and therefore uses the Internet services supplied via the headquarters ISP. The branch office can also connect directly to the Internet, independent of the headquarters office.

Installing an X330WAN Access Router in an Avaya G700 Media Gateway provides cost-effective and space-saving IP Telephony and WAN routing for SMEs (Small/Medium Enterprises).

The Avaya G700 Media Gateway and P330 switch can be stacked together to provide a comprehensive converged data and VoIP solution.

Small/Medium Business Connectivity Directly to a Service Provider

X330WAN enables SMEs to connect their LAN directly to an ISP, using a P330 switch. This solution provides independence and flexibility to the SMEs for data flow and other Internet services.

Functional Concepts Overview

Combining resources is an important component for success for today's businesses. X330WAN supplies you with combined required access functionality for branch offices and SMEs. X330WAN includes all functions necessary for branch office and SME connectivity.

X330WAN is designed to incorporate the following concepts:

- WAN access
- Routing
- Security
- Convergence

WAN Access

WAN access enables data and VoIP transfer by providing a link for routing packets between the WAN and Ethernet/LAN interfaces. WAN access enables connecting branch offices to headquarters, and providing fast access to the Internet and e-mail. VoIP services are enhanced when X330WAN is combined with the Avaya G700 Media Gateway or to the Avaya DEFINITY® Communications Server.

Routing

The X330WAN access router modules provide routing capabilities to a P330 switch. X330WAN routes packets between the WAN and LAN interfaces in the access router module. X330WAN provides support for the major routing protocols, as well as a Layer 3/Layer 4 Policy classifier. The Policy classifier works per Layer 2 interface and per direction, controlling access and QoS (tagging and mapping to internal queuing mechanism). X330WAN independently controls the traffic flow in the P330 from the LAN to the WAN. For more information about these features, refer to Chapter 4: *Operational Concepts and Configuration Examples*.

Security

Currently security can be implemented with X330WAN by connecting the X330WAN's Fast Ethernet port via an external firewall to a port on the P330 switch. The X330WAN module is connected to the Internet via its WAN ports. For more information and a sample configuration, refer to "Configuring the X330WAN for use with an External Firewall" on page 43.



Note: X330WAN contains the infrastructure for all security functionality planned for future releases, such as Firewall and VPN. Licenses will be issued for the different security options as the features become available.

Convergence

X330WAN enables a combined data and VoIP solution when used in conjunction with a VoIP gateway, such as the Avaya S8300 Media Server. You can build your VoIP network using several topologies, such as:

- Connecting a S8300 Media Server or G700 Media Gateway to the LAN's P333T/P333T-PWR/P330 stack, and inserting X330WAN in an expansion slot of one of the above devices.
- Connecting a DEFINITY with Prowler and CLAN cards to the LAN's P333T/P333T-PWR/P330 stack, and inserting X330WAN in an expansion slot of one of the above devices.

In addition, you need to connect standard IP phones to the P330 stack in either of the above topologies, or Avaya Legacy phones directly to the G700 Media Gateway. Using these solutions, X330WAN provides access to the corporate WAN with end-to-end QoS and Policy, ensuring the flawless functioning of the IP telephony.

Avaya X330WAN Network Management

Comprehensive network management is a key component of today's networks. Avaya provides multiple ways of managing X330WAN to suit your needs.

Command Line Interface (CLI)

The Avaya P330 CLI enables local or remote configuration of X330WAN. X330WAN configurations are saved in CLI format.

The X330WAN CLI is accessed via one of the following:

- Telnet to one of the IP interfaces of X330WAN.
- Use the **session wan** command from the Layer 2 agent of the stack, i.e. the Console port of the P330 stack master.

- Terminal Emulation connection to the Console port on X330WAN.
- Modem connection to the Console port on X330WAN.

Avaya P330 Device Manager (Embedded Web)

The built-in Avaya P330 Device Manager (Embedded Web Manager) allows you to manage X330WAN using a Web browser without purchasing additional software. This application works with the Microsoft® Internet Explorer and Netscape® Navigator web browsers and Sun Microsystems Java™ Plug-in.

Access the Device Manager by browsing to the Layer 2 agent (stack) IP address using your web browser. For more information on the Embedded Web Manager, refer to Appendix B: *Embedded Web Manager*.

Multiservice Network Manager (MSNM)

When you need extra control and monitoring, or wish to manage other Avaya LAN devices and wireless equipment, the Avaya MSNM is the right tool. This suite of management tools provides the ease-of-use and features necessary for optimal network utilization. MSNM supports the following operating environments:

- Windows NT®/2000 and Solaris 8.
- Stand-Alone mode with Windows NT/2000.
- HP OpenView for Windows NT/2000 and Solaris 8.

Requirements and Specifications

This section provides the X330WAN environmental requirements and technical specifications.

Environmental Specifications

X330WAN has the following environmental specifications.

Item	Description
Operating Temperature	-5 to 50° C (23–122°F)
Operating Humidity	5% to 95% relative humidity, non-condensing

Item	Description
Mechanical Shocks	TR-NWT-000063 - Network Equipment Building System, Generic Equipment Requirements, chapters: 4.4.1 Shock Criteria 4.4.2 Vibration Criteria 5.4.1 Shock and Vibration Test Methods

Power & Heat Dissipation

X330WAN has the following power and heat dissipation statistics:

- Power for the X330WAN comes from the P330. The X330WAN operational power is approximately 45 Watts.
- Heat dissipation: the X330WAN conforms to the P330 operating temperature range.

Installation

This chapter describes the X330WAN installation procedure, and includes the following sections:

- **Installation Safety Information** - Important information before connecting the X330WAN.
- **P330 Software Support for X330WAN** - Describes the P330 software versions to support the X330WAN modules.
- **Installing an X330WAN Module into an Avaya P330 Switch** - Describes the procedure for installing an X330WAN module in a P330 switch.
- **X330W-2DS1 Front Panel and LEDs** - Describes the X330W-2DS1 front panel and LEDs.
- **X330W-2USP Front Panel and LEDs** - Describes the X330W-2USP front panel and LEDs.
- **Avaya P330 LEDs** - Describes the P330 LEDs that relate to the X330WAN's functioning.
- **Connecting the X330WAN** - Describes the cables used to connect each of the X330WAN's ports.
- **Removing an X330WAN Module from an Avaya P330 Switch** - Describes the procedure for removing an X330WAN module from a P330 switch.

Installation Safety Information



Warning: Installation and removal of X330WAN must only be performed by qualified personnel.



Caution: Hold X330WAN only by the edges to avoid damage from static electricity. Do not touch the top or bottom of the circuit board. If possible, wear a wrist-strap and use an anti-static bag.

P330 Software Support for X330WAN

X330WAN enables you to connect your Avaya P330 switch to a WAN.

X330WAN can be inserted into Avaya P330 product line switches that include an expansion slot. These include the following Avaya P330 family switches and required software versions:

- Avaya P333T Embedded S/W Ver. 3.12 and higher
- Avaya P334T Embedded S/W Ver. 3.12 and higher
- Avaya P332MF Embedded S/W Ver. 3.12 and higher
- Avaya P333R Embedded S/W Ver. 3.12 and higher
- Avaya P333R-LB Embedded S/W Ver. 3.12 and higher
- Avaya P333T-PWR Embedded S/W Ver. 3.12 and higher

X330WAN can only be installed in the above Avaya switches using the firmware (embedded software) version 3.12 or higher. If you need to upgrade the software, obtain the latest version of the software from <http://www.avaya.com/support> and download it according to the instructions found in the User's Guide that accompanies your Avaya P330 switch.

You can view the firmware version of your Avaya switch using the `show image version` command.

Installing an X330WAN Module into an Avaya P330 Switch



Note: The X330WAN modules are not hot swappable. Removing/inserting an X330WAN with the power on resets the enclosing P330 switch.

To install an X330WAN access router module:

- 1 Remove the blanking plate or other expansion module from the P330 switch designated to house the X330WAN module.
- 2 Insert the X330WAN module gently into the slot, ensuring that the lower printed circuit board (PCB) is aligned with the guide rails. The PCB, not the metal base plate, fits into the guide rail.
- 3 Firmly press the X330WAN module until it is completely inserted into the P330 switch. If the module is not inserted completely, the P330 switch can not successfully reset.
- 4 Gently tighten the two screws on the front panel of the X330WAN module.



Note: Do not operate the Avaya P330 switch with the expansion slot open. If there is no expansion module in the slot, cover it with the supplied blanking plate.

- 5 Follow the post-installation checks, as described in "Power On Self Test" on page 11.

Power On Self Test

When you power up the Avaya P330 switch with a X330WAN module inserted, both the P330 switch and the X330WAN perform a self test. This test takes about 40 seconds to complete, and includes:

- Checksum tests of boot and system areas of Flash memory
- System memory tests
- MAC address verification test
- System timer test
- CAM (Contents Addressable Memory) tests
- Console Port tests
- Internal packet forwarding tests
- Switch and expansion module ASIC (Application Specific Integrated Circuit) tests
- Switch and expansion module ASIC memory tests
- Expansion module interface tests
- Expansion module packet forwarding tests

After you insert an X330WAN access router module into a powered P330 switch, causing a reset, or after a power cycle of the host P330 switch, the X330W-2DS1 startup sequence is as follows:

- 1 Initially all LEDs light for 15 seconds and then switch off.
- 2 The ALM LEDs light for 15 seconds and then switch off.
- 3 The TST LEDs light for 15 seconds and then switch off.
- 4 At this point, the ALM LED lights again if there is no line signal detected on the E1/T1 ports. If a signal is detected on the line, the SIG LEDs light and the ALM LEDs switch off.

The X330W-2USP startup sequence is as follows:

- 1 All LEDs light for 15 seconds, then switch off.
- 2 All LEDs remain off for 15 seconds.
- 3 The OPR LED lights and remains on.



Note: LED Number 51 on the Avaya P330 switch should be ON during the self-test procedure.

The X330WAN module must be inserted completely for the P330 switch to successfully reset.

X330W-2DS1 Front Panel and LEDs

The front panel of the X330W-2DS1 has two columns of four LEDs each, one for each Serial (WAN) port in the access router module. There is also a Fast Ethernet port, and a Console port for directly connecting a terminal. Between the LEDs and the Console port there is a RST/FIV button for manually resetting the module.

Figure 2.1 X330W-2DS1 Front Panel

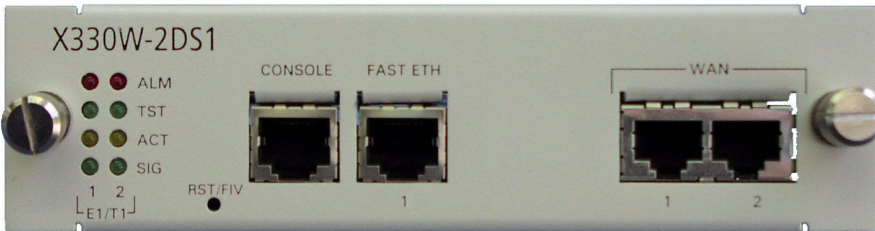


Table 2.1 describes the LEDs on the front panel of the X330W-2DS1.

Table 2.1 X330W-2DS1 LED Descriptions

LED Name	Color	Description	LED Status
ALM	Red	Alarm	ON - Module is initializing, or when an alarm state exists on an interface.
			OFF - Initialization successful, module software functioning properly, no alarm conditions on an interface.
TST	Green	Test	ON - Port is being initialized or loopback is active.
			OFF - Port initialization completed and loopback is not active.
ACT	Yellow	Active	ON - At least one PPP/Frame Relay session is active.
			OFF - No active PPP/Frame Relay session.
SIG	Green	Signal	ON - A signal is detected on the port.
			OFF - No signal is detected on the port.

X330W-2USP Front Panel and LEDs

The front panel of the X330W-2USP has a column of two LEDs for each Serial port in the access router module, and an Operational LED displaying module status. There is also a Fast Ethernet port, and a Console port for directly connecting a terminal. Between the LEDs and the Console port there is a RST/FIV button for manually resetting the module.

Figure 2.2 X330W-2USP Front Panel

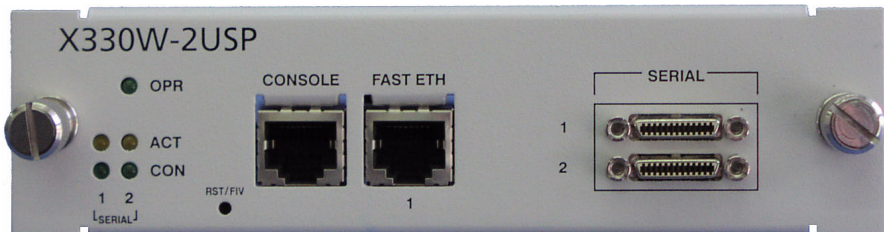


Table 2.1 describes the LEDs on the front panel of the X330W-2USP.

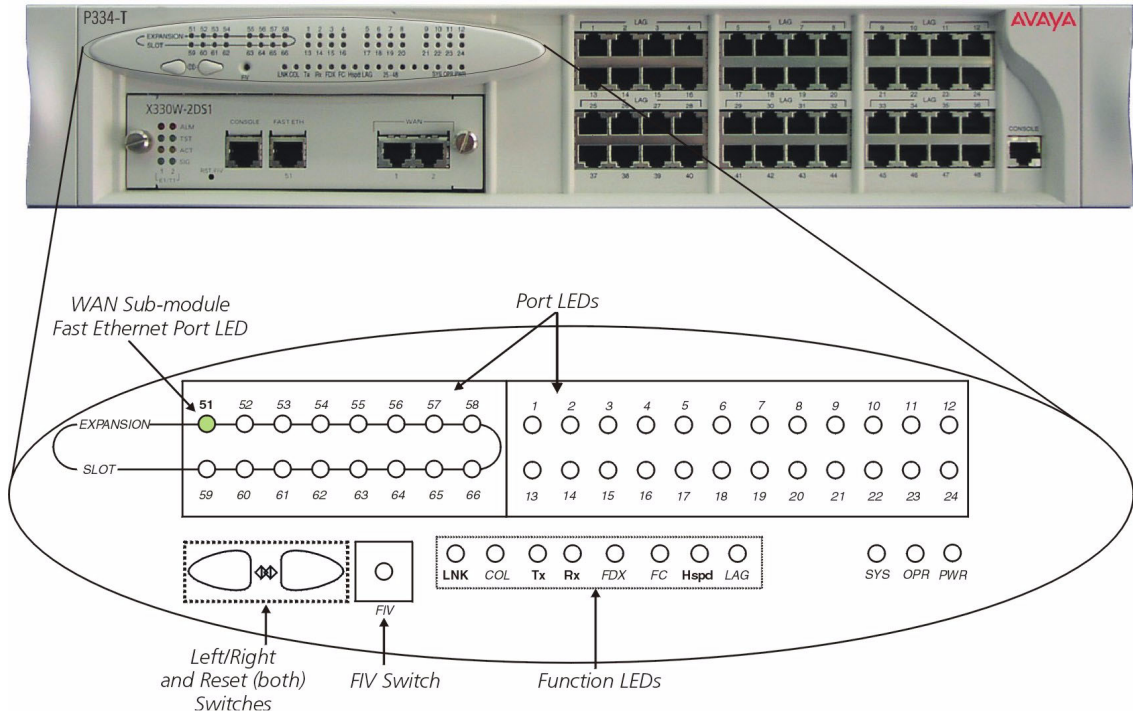
Table 2.2 X330W-2USP LED Descriptions

LED Name	Color	Description	LED Status
OPR	Green	Operational	ON - The module is operational.
			OFF - The module initialization has failed.
ACT	Yellow	Active	ON - At least one PPP/Frame Relay session is active.
			OFF - No PPP or Frame Relay sessions are active.
CON	Green	Connected	ON - DCD, DSR, and CTS are active.
			OFF - A line is inactive or an interface is down.

Avaya P330 LEDs

Figure 2.3 shows an Avaya P330 Switch front panel and a detailed view of the LEDs used when an X330WAN is installed.

Figure 2.3 Avaya P330 Front Panel LED Indicators



Note: All LEDs light while the P330 switch resets.

The P330 switch front panel LEDs consist of Port LEDs and Function LEDs, as shown in Figure 2.3. The Function LEDs display the selected function for the ports indicated by the Port LEDs. The function is selected by pressing the Left/Right switch until the desired function LED is illuminated. Pressing the same switch again moves to the next function.

When the X330WAN module is installed in a P330 switch, Port LED number 51 displays the status of the X330WAN Fast Ethernet port according to the selected function. Port LED number 51 is off when Fast Ethernet port is administratively disabled.

For a description of the other LEDs on the front panel of the Avaya P330 switch, refer to the User's Guide that accompanies your switch.

Connecting the X330WAN

This section describes the cables used to connect the X330WAN.

Connecting the E1/T1 WAN Ports

Use an RJ-48C cable, minimum 26 gauge, to connect the E1/T1 WAN ports on the X330WAN to the network wall jack.

Connecting the USP Ports

X330W-2USP supports several interface types for the Serial ports. The X330W-2USP automatically detects the cable type used and determines the Serial protocol needed. You can order the following types of 3 meter length adaptor cables for the different interfaces.

- V.35 interface - SCSI-M34 DTE cable
- X.21 interface - SCSI-DB-15 DTE cable
- EIA530A interface - SCSI-DB-25 DTE cable



Note: The X330W-2USP module is a DTE, therefore the cables associated with this module have male connectors on both ends. If a cable with a female connector on one end is used (a DCE cable), the X330W-2USP CLI alerts you that the wrong cable is connected.

For pinouts of the above cables, refer to Appendix A: *Interface Specifications*.

Connecting the Fast Ethernet (10/100Base-T) Port

Connect a UTP Category 5 cable with an RJ-45 connector to the 10/100Base-T port. The maximum UTP cable length connected to the 10/100Base-T port is 100m (328 ft.).

You can obtain appropriate cables from your local supplier.

Connecting the Console Port

The port on the front panel labelled “Console” is for connecting a terminal or a modem, and has an RJ-45 connector. Connect the X330WAN module to a terminal using the supplied console cable and the RJ-45 to DB-9 adaptor. To connect a modem, use the supplied cable and an RJ-45 to DB-25 adaptor.

For pinouts of the Console cables, refer to Appendix A: *Interface Specifications*.



Note: The cable and two adaptors can be found in the Avaya P330 accessory set, and are clearly marked.

Removing an X330WAN Module from an Avaya P330 Switch

To remove an X330WAN module from a P330 switch:

- 1 Loosen the screws on the front panel of the X330WAN module that secure the module to the P330 switch.
- 2 Grasp the two screw knobs and pull gently but firmly towards yourself. The X330WAN module slides out of the slot.
- 3 Insert another expansion module or the blanking plate into the switch.

Initial Configuration

This chapter describes the initial configuration of the X330WAN, and includes the following sections:

- **Configuring the X330WAN** - Describes how to configure an X330WAN Fast Ethernet, FabricFast Ethernet, E1/T1, USP, or Loopback interface, and which commands to use to display and save your configuration.
- **X330WAN Default Settings** - Lists the default settings of the X330WAN.

Configuring the X330WAN

X330WAN can be configured using the Command Line Interface (CLI) utility, the built-in Avaya P330 Device Manager (Embedded Web), or Avaya MultiService Network Manager (MSNM™).

For instructions on using the CLI, refer to Chapter 6: *X330WAN CLI Commands*. For instructions on using the Device Manager or Avaya MultiService Network Manager™, refer to the Avaya MultiService Network Manager or P330 Device Manager User's Guide on the Documentation and Utilities CD.

The CLI is command-line driven and does not have any menus. To activate a configuration option, type the desired command at the prompt and press Enter.

This section describes how to do the following using the CLI:

- Establish a console and modem connection.
- Configure an X330WAN Loopback, Fast Ethernet, FabricFast Ethernet, E1/T1, and USP interface.
- Check and save your configuration.
- Establish a Telnet session.

Establishing a Console Connection

Perform the following steps to connect a terminal to the Console port of the X330WAN module for configuration of WAN parameters using the CLI:

- 1 Use the supplied cable to attach the RJ-45 console connector to the Console port on the X330WAN module. Connect the DB-9 connector to the serial (COM) port on your PC/terminal.
- 2 Use the following port settings on the terminal:
 - Baud Rate - 9600 bps
 - Character Size - 8

- Parity - None
- Stop Bit - 1
- Flow Control - None
- Terminal Emulation - VT-100



Note: The terminal connected to the Console port must be configured with these settings.

- 3 Press Enter.
- 4 When prompted for a Login Name, enter the default name **root**.
- 5 When prompted for a password, enter the password **root**.

Establishing a Modem Connection

A PPP connection with a modem can be established only after the X330WAN is configured with an IP address and net-mask. Also, the parameters used in the X330WAN must be compatible with the modem's parameters.

All CLI commands mentioned in this section are described in Chapter 6: *X330WAN CLI Commands*.

To configure a modem interface:

- 1 Connect a terminal to the console port of the X330WAN, as described in "Establishing a Console Connection" on page 17.
- 2 At the prompt, type: **interface console** and press Enter.
- 3 Enter an IP address and subnet mask for the X330WAN to connect via its PPP interface using the **ip address** <ip address> <mask> command.



Note: The PPP interface, configured within the **interface console** context, must be on a different subnet from the router interfaces.

- 4 Set the baud rate, PPP authentication, and PPP timeout required to match your modem using the following commands:

```
speed <9600|19200|38400>
```

```
ppp authentication <chap|none|pap>
```

```
timeout absolute <time>. The time entered is in minutes.
```

- 5 Type: **async mode interactive**

The CLI responds with the following:

```
Entering the Modem mode would occur automatically upon proprietary  
modem-cable plug-in into the console port. The terminal mode would  
be restored automatically upon insertion of proprietary terminal-  
cable.
```


- 6 Connect the Console port to the modem's DB-25 port using the DB-25 to RJ-45 connector. The X330WAN enters Modem mode.
- 7 Dial into the module from a remote station, and open a Telnet session to the PPP interface IP address configured in step 3.

Checking the Modem Configuration

After establishing a modem connection, use the **show interface console** command to display information regarding your modem interface. Verify that the output information is correct.

Establishing a Telnet Connection

Perform the following steps to establish a Telnet connection to the X330WAN for configuration of WAN parameters. Telnet directly to one of the IP interfaces of the X330WAN:

- 1 Connect your station to the network.
- 2 Verify that you can communicate with the X330WAN using the **ping** <host> [<interval> [<size>]] command to the IP of the X330WAN. If there is no response, check the IP address and default gateway of both the X330WAN and the station using the **show ip route** command.
- 3 From the Microsoft Windows taskbar of your PC, click **Start** and then **Run** (or from the DOS prompt of your PC), then start the Telnet session by typing:
telnet <IP address of X330WAN>
For example: telnet 149.49.32.134



Note: You can also Telnet the IP address of the P330 stack. If you Telnet the IP address of the stack, a connection is established with the Switch CLI entity of the Master module of the stack.

If you want to connect to the X330WAN CLI entity, use the **session wan** <module number in stack> command.

- 4 When prompted for a Login Name, enter the default name **root**.
- 5 When prompted for a password, enter **root**. You can now configure the X330WAN.

Configuring Loopback Interfaces

All CLI commands mentioned in this section are described in Chapter 6: *X330WAN CLI Commands*.

To configure Loopback interfaces:

- 1 Enter the Interface Loopback mode using the **interface Loopback** [<interface number>[.ip-interface]] command.
For example: typing **interface loopback 1** enters a context for configuring the Loopback1 interface parameters.
The prompt changes to `X330WAN-2DS1-N(super-if:Loopbackn)#` where `N` is the switch number and `n` is the Loopback interface number.
- 2 Use the **ip address** <ip address> <mask> command to assign an IP address and subnet mask to the interface.
- 3 Type **exit** to return to Supervisor mode.
The prompt returns to `X330WAN-2DS1-N(super)#`



Note: The first IP interface created in the X330WAN automatically becomes the PMI (Primary Management Interface), described in detail on page 34. It is recommended to configure the Loopback interface as the first Layer 2 interface and to configure an IP interface on it. After the PMI is configured, the following message appears:

The primary management interface has changed.

For this change to take effect, you need to copy running-config startup-config and then reset the device.

Enter the **copy running-config startup-config** and **reset** commands at this stage.

Configuring Fast Ethernet Interfaces

All CLI commands mentioned in this section are described in Chapter 6: *X330WAN CLI Commands*.

To configure Fast Ethernet interfaces:

- 1 Type **interface FastEthernet 1** to enter the Interface Configuration mode.
The prompt changes to `X330WAN-2DS1-N(super-if:FastEthernet1)#`
- 2 Use the **ip address** <ip address> <mask> command to assign an IP address and subnet mask to the interface.
- 3 Type **exit** to return to Supervisor mode.
The prompt returns to `X330WAN-2DS1-N(super)#`



Note: The first IP interface created in the X330WAN automatically becomes the PMI, described in detail on page 34. It is recommended to configure the Loopback interface as the first Layer 2 interface and to configure an IP interface on it. After the

PMI is configured, the following message appears:

The primary management interface has changed.

For this change to take effect, you need to copy `running-config` startup-config and then reset the device.

Enter the **copy running-config startup-config** and **reset** commands at this stage.

Configuring the FabricFast Ethernet Interface

All CLI commands mentioned in this section are described in Chapter 6: *X330WAN CLI Commands*.

To configure a FabricFast Ethernet interface:

- 1 Use the **interface FabricFastEthernet** <if-number> command to enter the FabricFast Ethernet interface context, where the if-number format is `port[:vlan[.ip-interface index]]`.



Note: You do not need to include the ip-interface index if you configure only one IP interface.

- 2 Use the **ip address** command to assign an IP address to the interface.

For example: To configure the IP addresses 10.10.10.1 on VLAN 2 and 20.20.20.1 and 30.30.30.1 on VLAN 3 perform the following:

```
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:2
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # ip address
10.10.10.1 24
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # exit
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:3.1
X330WAN-2USP-1 (super-subif:FabricFastEthernet1:3.1) # ip address
20.20.20.1 24
X330WAN-2USP-1 (super-subif:FabricFastEthernet1:3.1) # exit
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:3.2
X330WAN-2USP-1 (super-subif:FabricFastEthernet1:3.2) # ip address
30.30.30.1 24
X330WAN-2USP-1 (super-subif:FabricFastEthernet1:3.2) # exit
```



Note: The first IP interface created in the X330WAN automatically becomes the PMI, described in detail on page 34. It is recommended to configure the Loopback interface as the first Layer 2 interface and to configure an IP interface on it. After the PMI is configured, the following message appears:

The primary management interface has changed.

For this change to take effect, you need to copy running-config startup-config and then reset the device.

Enter the **copy running-config startup-config** and **reset** commands at this stage.

Configuring E1/T1 Interfaces

All CLI commands mentioned in this section are described in Chapter 6: *X330WAN CLI Commands*.

For a list of X330WAN default settings, see "X330WAN Default Settings" on page 28, or use the **show controllers** <port number> command to display all of the current settings.

To configure E1 or T1 interfaces:

- 1 Use the **show controllers** <port number> command to check if your controller's mode is configured as E1 or T1.
Use the **ds-mode** [e1|t1] command to set the controller's mode to E1 or T1. Changing the line type requires resetting the module.
- 2 Use the **controller** [e1|t1] <port number> command to enter the context of the port to be configured.
The prompt changes to X330WAN-2DS1-N(super-controller:n)# where N is the switch number and n is the port number.
- 3 Use the following commands if you want to change the clock source, frame type and linecode parameters from their default settings:
clock source [line|internal]
framing [sf|esf] for T1 lines or **framing** [crc4|no-crc4|unframed] for E1 lines.
linecode [ami|b8zs] for T1 lines or **linecode** [ami|hdb3] for E1 lines.
cablelength [long|short] for T1 lines.
For T1 mode proceed to step 5.
- 4 Use the **channel-group** <channel-number> **timeslots** <timeslot-list> command to specify the channel group and time slots to be mapped. For example, typing
channel group 1 timeslots 1,3-5,7 configures time slots numbered 1, 3-5 and 7 to be mapped in channel-group number 1.
Proceed to step 6.
- 5 Use the **channel-group** <channel number> **timeslots** <timeslot list> **speed** [56|64] command to specify the channel group, time slots to be mapped and DS0 speed in kbps. For example, typing
channel group 1 timeslots 1,3-5,7 speed 64 configures time slots numbered 1, 3-5, and 7 to be mapped in channel-group number 1 and the DS0 speed to 64 kbps.

- The default DS0 speed is 56 kbps
- 6 Type **exit** to return to Supervisor mode.
The prompt returns to X330WAN-2DS1-N(super) #
 - 7 Use the **interface Serial** <port:channel-group>.<ip-interface>> command to configure each channel group as a virtual Serial interface. Specify the port number and channel group number to modify.
For example: typing **interface Serial 1:1** configures a Serial interface on port number 1 with a channel group number 1.
 - 8 Change the encapsulation to Frame Relay if required, using the **encapsulation frame-relay** command.
If Frame Relay encapsulation was selected, continue with step 13.



Note: After the Serial interface is created, its default encapsulation is PPP.

- 9 Use the **ip address** <ip address> <mask> command to assign an IP address and subnet mask to the interface.
- 10 Type **exit** to return to Supervisor mode.
The prompt returns to X330WAN-2DS1-N(super) #
This completes the procedure for PPP encapsulation.
- 11 Repeat step 4 through step 10 if you want to configure another serial interface on the same E1/T1 port.
- 12 Repeat step 2 through step 10 if you want to configure another E1 or T1 interface.
- 13 Use the **frame-relay lmi** commands to change the Local Management Interface (LMI) parameters from their default values if required, or use the **frame-relay traffic-shaping** command to activate Traffic Shaping on the Frame Relay interface. For more information on Traffic Shaping, refer to "Traffic Shaping and Marking" on page 47.
- 14 Type **exit** to return to Supervisor mode.
- 15 Use the **interface serial** <if-number>[<if-link-type>] command to enter the Frame Relay Sub-interface context. (For example, typing **interface serial 2:3.1 point-to-point** creates a Point-to-Point type Sub-interface 1 on port 2, channel-group 3.)



Note: Currently only Point-to-Point Sub-interface types are supported.

- 16 Configure a Data Link Connection Identifier (DLCI) for the Sub-interface using the **frame-relay interface-dlci** <DLCI number> command.
- 17 If required, configure a Priority DLCI Group using the **frame-relay priority-dlci-group** <DLCI1> [<DLCI2> [<DLCI3> [<DLCI4>]] command.

For more information, refer to "Priority DLCI" on page 46.

- 18 Configure an IP address for the Sub-interface using the **ip address** <ip address> <mask> [<admin state>] command.
- 19 Type **exit** to return to Supervisor mode.
- 20 Repeat step 3 through step 6 to configure additional Frame Relay Sub-interfaces on the same Frame Relay interface.



Note: If the Unframed framing option was selected in step 3 for an E1 port, a Channel Group is automatically created comprising the entire E1 bandwidth. This Channel Group has the number '0', and for all the subsequent configuration for this interface use the context **interface serial n:0** where 'n' is the port number.



Note: The first IP interface created in the X330WAN automatically becomes the PMI, described in detail on page 34. It is recommended to configure the Loopback interface as the first Layer 2 interface and to configure an IP interface on it. After the PMI is configured, the following message appears:

The primary management interface has changed.

For this change to take effect, you need to copy running-config startup-config and then reset the device.

Enter the **copy running-config startup-config** and **reset** commands at this stage.

Table 3.1 provides the different configuration contexts for the X330W-2DS1 CLI. This table uses the following legend:

- x = physical port number
- y = channel group
- z = sub frame relay interface index
- w = IP interface index
- v = VLAN number

Table 3.1 X330W-2DS1 CLI Interface Contexts

CLI Interface Context	PPP	Frame Relay
Controller	controller e1 (t1) x	controller e1 (t1) x
Serial	interface serial x:y	interface serial x:y
Sub Frame Relay	N/A	interface serial x:y.z point-to-point

Table 3.1 X330W-2DS1 CLI Interface Contexts (Continued)

CLI Interface Context	PPP	Frame Relay
IP	interface serial x:y.w	interface serial x:y.z.w
FastEthernet	interface fastethernet 1.w	interface fastethernet 1.w
FabricFastEthernet	interface fabricfastethernet 1:v.w	interface fabricfastethernet 1:v.w

Configuring USP Interfaces

All CLI commands mentioned in this section are described in Chapter 6: *X330WAN CLI Commands*.

For a list of X330WAN default settings, see "X330WAN Default Settings" on page 28, or use the **show interfaces** [*<type>*] [*<identifier>*] command to display all of the current settings.

To configure USP interfaces:

- 1 Use the **interface serial** *<if-number>* command to enter the context of the port you want to configure.
- 2 Use the following commands if you want to change the idle characters, transmitter delay, encoding type, and bandwidth parameters from their default settings:
 - idle characters** *<flags|marks>*
 - transmitter-delay** *<number>*



Note: The **transmitter-delay** command is used usually when the DCE equipment that is connected directly to the X330W-2USP, or the router on the WAN have a receive buffer not large enough to hold the traffic sent by the X330W-2USP. In this case, configure **transmitter-delay** on the DCE equipment or the remote router in order to preserve the high performance that you had when **transmitter-delay** was configured to 0 on the X330W-2USP.

```
nrzi-encoding
bandwidth <kilobits size>
```

- 3 If required, change the interface encapsulation to Frame Relay using the **encapsulation frame-relay** command. If you selected Frame Relay encapsulation, continue with step 7.
- 4 Use the **ip address** *<ip address>* *<mask>* command to assign an IP address and a Subnet mask to the interface.
- 5 Type **exit** to return to Supervisor mode.



Note: If you need to define more than one IP address on the interface, enter a new **interface serial n.m** context, where **n** is the port number and **m** is the additional IP interface. (For example: typing **interface serial 1.1** enables you to configure an IP interface on interface Serial 1, in addition to the IP interface created in step 4.)

- 6 Repeat step 1 through step 5 to configure the second USP interface if needed.
 - 7 Use the **frame-relay lmi** commands to change the Local Management Interface (LMI) parameters from their default values if required, or use the **frame-relay traffic-shaping** command to activate Traffic Shaping on the Frame Relay interface. For more information on Traffic Shaping, refer to "Traffic Shaping and Marking" on page 47.
 - 8 Type **exit** to return to Supervisor mode.
 - 9 Use the **interface serial <if-number> [<if-link-type>]** command to enter the Frame Relay Sub-interface context. (For example, typing **interface serial 2.1 point-to-point** creates a Point-to-Point type Sub-interface 1 on port 2.)
-



Note: Currently only Point-to-Point Sub-interface types are supported.

- 10 Configure a Data Link Connection Identifier (DLCI) for the Sub-interface using the **frame-relay interface-dlci <DLCI number>** command.
- 11 If required, configure a Priority DLCI Group using the **frame-relay priority-dlci-group <DLCI1> [<DLCI2> [<DLCI3> [<DLCI4>]]]** command. For more information, refer to "Priority DLCI" on page 46.
- 12 Configure an IP address for the Sub-interface using the **ip address <ip address> <mask> [<admin state>]** command.
- 13 Type **exit** to return to Supervisor mode.
- 14 Repeat step 9 through step 12 to configure additional Frame Relay Sub-interfaces on the same Frame Relay interface.

Table 3.1 provides the different configuration contexts for the X330W-2USP CLI. This table uses the following legend:

- x = physical port number
- y = channel group
- z = sub frame relay interface index
- w = IP interface index

- v = VLAN number

Table 3.2 X330W-2USP CLI Interface Contexts

CLI Interface Context	PPP	Frame Relay
Serial	interface serial x	interface serial x
Sub Frame Relay	N/A	interface serial x.z point-to-point
IP	interface serial x.w	interface serial x.z.w
FastEthernet	interface fastethernet 1.w	interface fastethernet 1.w
FabricFastEthernet	interface fabricfastethernet 1:v.w	interface fabricfastethernet 1:v.w

Checking the Loopback, Fast Ethernet, E1/T1/USP, IP Interface Configuration

After configuring the new interface, you can perform the following tests to verify that the new interface is operating correctly.

- For the X330-2DS1, use the **show controllers** <port> command to display the status of the controller for E1/T1 interfaces.
- Use the **show interfaces** <type> <identifier> command to display information on all interfaces: Fast Ethernet, FabricFast Ethernet, Serial, Console, and Loopback. Verify that the output information is correct.
- Use the **show frame-relay pvc** [<interface-name>|<dlci number>] command to display the Frame Relay interface configuration.
- Use the **show ip interface** [<interface-name>|<IP interface>|<ip-address>] command to display IP interface configured Serial and Ethernet ports.
- Use the **show running-config** command to display the configuration running on the switch.
- Use the **show startup-config** command to display the configuration loaded at startup.
- Use the **ping** <host> [<interval> [<size>]] command to send ICMP echo request packets to another node on the network. Each node is periodically pinged and checked if an answer was received. This checks host reachability and network connectivity.

Saving Your Configuration

To save your configuration, type **copy running-config startup-config**. This copies your X330WAN configuration from the current VRAM Running Configuration to the Startup Configuration NVRAM.



Note: Unsaved configurations are lost after each reset or after a power failure.

X330WAN Default Settings

The default settings for the X330WAN and its ports are determined by its firmware. These default settings are subject to change. Newer versions of the software for the X330WAN can be downloaded from the Avaya Network Software Download Web site at <http://www.avaya.com/support>.

Table 3.3 provides the X330W-2DS1 default settings.

Table 3.3 X330W-2DS1 Default Settings

Function	Default Setting
Port Speed (Fast Ethernet)	100 Mbps
Port Duplex (Fast Ethernet)	Full Duplex
Auto-Negotiation (Fast Ethernet)	Enabled
WAN mode (WAN)	T1
Framing (WAN)	SF for T1, CRC4 for E1
Linecode (WAN)	AMI for T1, HDB3 for E1
Clock Source (WAN)	line
Cable Length (for T1)	long, gain26, 0db
Speed (for T1)	56
SNMP Community	public
Avaya X330WAN CLI Entry Login	Login name: root , Password: root

Table 3.4 provides the X330W-2USP default settings.

Table 3.4 X330W-2USP Default Settings

Function	Default Setting
Port Speed (Fast Ethernet)	100 Mbps
Port Duplex (Fast Ethernet)	Full Duplex
Auto-Negotiation (Fast Ethernet)	Enabled
Encoding	NRZ
Bandwidth	2048Kbps
Line-Up Indicator Signal	DCD
SNMP Community	public
Avaya X330WAN CLI Entry Login	Login name: root , Password: root

Operational Concepts and Configuration Examples

This chapter provides information about the X330WAN functional concepts, as well as sample configurations illustrating the implementation of these concepts. This chapter contains the following sections:

- **Detailed Interface Concepts** - Describes the X330WAN physical and virtual interfaces, and their uses.
- **Enhanced Routing Capabilities** - Provides information about Static Route Configuration, Export Default Metric, OSPF Dynamic Cost Support, RIP Distribution Access Lists, and Fragmentation and Reassembly. This section contains a sample configuration illustrating the implementation of these concepts.
- **Backup Interfaces** - Provides a description of backup interfaces, and describes how to implement them on X330WAN.
- **Frame Relay Encapsulation** - Provides information about the X330WAN's QoS implementation for PPP encapsulation and Frame Relay encapsulation.
- **Policy** - Provides information about controlling network access to the X330WAN.
- **RTP Header Compression (cRTP)** - Describes the X330WAN's implementation of cRTP.
- **QoS and VoIP Treatment** - Describes how X330WAN uses Quality of Service, and handles VoIP traffic.
- **VoIP Implementation with a G700 Media Gateway and an S8300 Media Server** - Provides a sample configuration illustrating the implementation of the above concepts.
- **VoIP Implementation with DEFINITY (CLAN and Prowler)** - Provides a sample configuration illustrating the above concepts with DEFINITY.

Detailed Interface Concepts

X330WAN includes physical, Layer 2 virtual, and Layer 3 routing interfaces.

Physical Interfaces

The following are the X330WAN physical interfaces:

- **WAN Interfaces** – 2 ports, configurable for E1 or T1, or 2 USP ports.

- **LAN Interface** – Fast Ethernet interface.
This interface is an autosensing 10/100Mbps Fast Ethernet port. It can be used to connect to a LAN, to an external firewall/VPN, or to a DMZ.
- **P330 Switching Fabric** – FabricFastEthernet interface.
This is an internal 100Mbps connection to the P330 switching fabric. It supports VLANs, and is compatible with the P330.
When connecting the X330WAN in Access-Router Only mode (e.g., no external VPN or firewall), this interface is used to connect to the hosting P330 switch. If an external firewall/VPN is connected to the Fast Ethernet port, it is important to disable this interface to prevent a direct flow of packets from the WAN to the LAN.
- **Console Interface** – Used to connect a terminal for local management, or a modem for remote management.

Layer 2 Virtual Interfaces

The following are the X330WAN Layer 2 virtual interfaces:

- **Loopback** – A virtual Layer 2 interface over which Loopback IP addresses are configured. The Loopback interface represents the router by an IP address that is always available, a feature necessary mainly for network troubleshooting. The Loopback interface also provides a 'Router ID' in the OSPF routing protocol.
Since the Loopback interface is not connected to any physical interface, an entry in the routing table can not have the Loopback interface's subnet as its next hop.
- **VLAN (on the FabricFastEthernet Interface)** – The P330 switch can have multiple VLANs defined within its switching fabric. X330WAN supports up to 253 VLANs that can be configured over its internal FabricFastEthernet connection.
- **Serial Interface** – This is a virtual interface that is created over a portion of an E1/ T1, or USP port.
The Serial interfaces support PPP and Frame Relay encapsulation protocols.



Note: One or more IP interfaces can be defined over each Serial, Fast Ethernet, or FabricFastEthernet interfaces.

Figure 4.1 through Figure 4.4 provide graphic representations of the X330WAN serial interfaces.

Figure 4.1 illustrates a Layer 1 T1 port with two Channel Groups defined. All data from each Channel Group is encapsulated using PPP protocol, and is distributed over the multiple IP interfaces defined for each Channel Group.

Figure 4.1 T1 Port with PPP Encapsulation

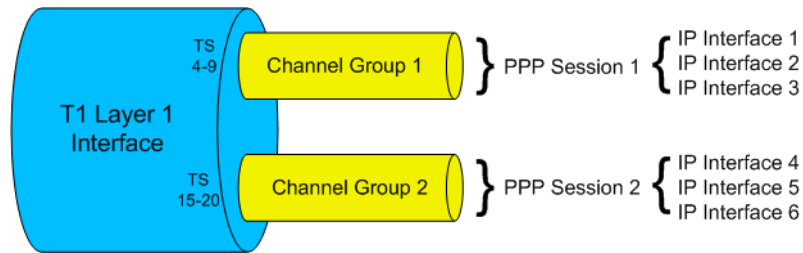


Figure 4.2 illustrates an E1/T1 port Channel Group. All data from the Channel Group is encapsulated using Frame Relay protocol, and is sent via a Frame Relay Serial interface and Sub-interfaces over the multiple IP interfaces defined using DLCI (Data Link Connection Identifier).

Figure 4.2 E1/T1 Port with Frame Relay Encapsulation

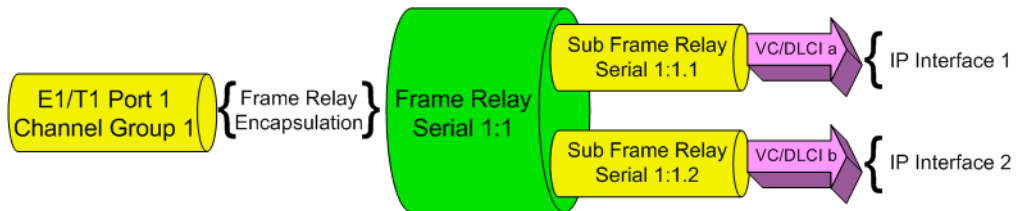


Figure 4.3 illustrates a USP port. All data from the USP port is encapsulated using Frame Relay protocol, and is sent via a Frame Relay Serial interface and Sub-interfaces over the single IP interfaces defined using DLCI.

Figure 4.3 USP Port with Frame Relay Encapsulation

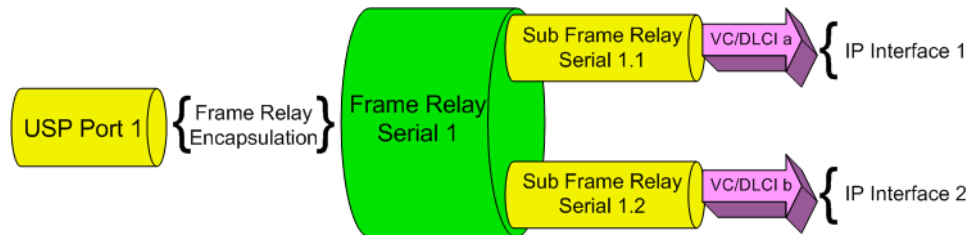
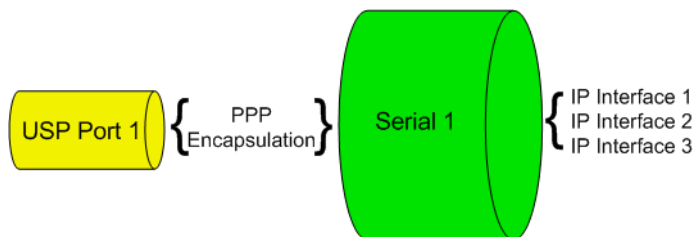


Figure 4.4 illustrates a USP port. All data from the USP port is encapsulated using PPP protocol, and is sent via a Serial interface over the multiple IP interfaces defined.

Figure 4.4 USP Port with PPP Encapsulation



- PMI (Primary Management Interface)** - This is a unique Layer 3 interface that can be configured over any Layer 2 interface. The PMI is the X330WAN management interface, through which the X330WAN's management applications access the device. The PMI is used when downloading software or opening an Embedded Web session to X330WAN. In both cases, a route should exist between the TFTP server or the management station and the PMI IP address.



Note: The first IP interface created in X330WAN automatically becomes the PMI. It is recommended to configure the Loopback interface as the first Layer 2 interface and to configure an IP interface on it. After the PMI is configured, the following message appears:

The primary management interface has changed.

For this change to take effect, you need to copy running-config startup-config and then reset the device.

Enter the **copy running-config startup-config** and **reset** commands at this stage.

You can not delete a PMI Layer 3 interface unless it is the last interface configured, or unless the PMI function is first assigned to another IP interface.

- Supporting an End point in Frame Relay Point to Multi-point Topology** - X330WAN supports Point-to-Point Frame Relay connections. To enable you to use X330WAN as an end-point in a Point to Multi-Point (PTMP) topology, it supports Inverse ARP replies, and responds to Inverse ARP queries received on the Frame Relay Sub-interfaces with proper Inverse ARP replies. When you connect X330WAN as an end-point in a Point to Multi-Point (PTMP) configuration, manually increase the OSPF timers to suit this topology using the **ip ospf network point-to-multipoint** command from the Interface Serial context. This command increases the OSPF Hello and Dead Intervals to 30 and 120 seconds respectively.

Enhanced Routing Capabilities

This section describes the following X330WAN routing features:

- Static Route Configuration
- Export Default Metric
- OSPF Dynamic Cost Support
- RIP Distribution Access Lists
- Fragmentation and Reassembly

The following configuration examples integrating the above concepts are provided:

- Configuring X330WAN to Connect Branch Offices to Headquarters
- Configuring the X330WAN for use with an External Firewall

Static Route Configuration

Static routes can be configured to the X330WAN. They are never timed-out, and can only be removed by manual configuration. Deletion (by configuration) of the IP interface deletes the static routes using this interface as well.

A static route becomes inactive whenever the underlying Layer 2 interface is down, except for Permanent Static Routes, described on page 36. When the underlying Layer 2 interface becomes active, the static route re-enters the routing table again.

Static routes can be configured as next using the following:

- **“via interface” route** - via local serial interface, as described on page 36.
- **Next-hop IP address** - Destinations that are reachable via another router as a next hop. The next hop router must belong to one of the directly attached networks for which X330WAN has an IP interface.

Two kinds of static routes can be configured, High Preference static routes which are preferred to routes learned from any routing protocol and Low Preference static routes which are used temporarily until the route is learned from a routing protocol. By default, a static route has Low Preference.

Static routes can be advertised by routing protocols (i.e. RIP, OSPF) as described under Route redistribution.

Static routes also support load-balancing similar to OSPF. You can configure up to three next-hops for each static route in one of the following manners:

- Enter all of the next-hops using a single **ip route** command. To add a new next-hop to an existing static route, enter the new next-hop individually, as in the following option.
- Enter each next-hop individually with its own **ip route** command.



Note: Using the **no ip route** command deletes the route including all of its next-hops, whether entered individually or with a single command.

For example: To specify next-hops 149.49.54.1 and 149.49.75.1 as a static route to the network 10.1.1.0, perform one of the following:

- Use the single **ip route 10.1.1.0 24 149.49.54.1 149.49.75.1** command specifying all next-hops together.
- Use the individual **ip route 10.1.1.0 24 149.49.54.1** and **ip route 10.1.1.0 24 149.49.75.1** commands.



Note: Next-hops can only be added to an existing static route if they have the same preference and metric as the currently defined next-hops.

X330WAN supports the following Static Route configurations:

- “via interface” Static Route
- Permanent Static Route
- Discard Route

These configurations are described below.

“via interface” Static Route

PPP and Frame Relay allow for a Layer 3 interface to be established without knowing in advance what the next-hop on the other side of a Serial link is. In this case you can specify a Serial Layer 2 interface as a next-hop instead of providing a specific next-hop IP address. This is equivalent to specifying the node on the other side of the Serial link as the next-hop when its IP address is unknown. The “via interface” option is configured by specifying the type and the number of the Serial interface using the **ip route** command.

For example: The command **ip route 193.168.10.0 24 serial 1:1** creates a static route to the network 193.168.10.0 24 via the Serial 1:1 interface.

A static route can have both “via interface” and IP addressed next-hops, with a maximum of three next-hops. If such a combination is required, separate **ip route** commands should be used for the “via interface” static route and the IP addressed next-hop routes. Also, if more than one “via interface” next-hops are required, each must be configured by separate **ip route** commands.

Permanent Static Route

X330WAN enables you to configure a static route as a permanent route. Configuring this option prevents the static route from becoming inactive whenever the underlying Layer 2 interface is down. This prevents routing table updates from being sent each time an interface goes up or down when there is a fluctuating Layer 2 interface on the static route.

Configure the ‘permanent’ option using the **ip route** command.

For example: The command `ip route 193.168.10.0 24 serial 1:1 permanent` creates a permanent static route to the network 193.168.10.0 24 via the Serial 1:1 interface.



Note: Permanent static routes should not be configured over Serial Layer 2 interfaces that participate in a Primary-Backup pair. For more information on Backup interfaces, refer to "Backup Interfaces" on page 44.

Discard Route

Discard Route enables you to prevent forwarding traffic to specific networks. You can configure a static route that drops all packets destined to it. This is called a discard route, indicated by the "null0" parameter, and is configured using the `ip route <network> <mask> null0` command.

For example: the command `ip route 134.66.0.0 16 Null0` specifies the network 134.66.0.0 16 as a discard route.

Export Default Metric

X330WAN enables you to configure the metric to be used in updates that are redistributed from one routing protocol to another.

In RIP, the default is 1 and the maximum value is 16. In OSPF, the default is 20.

Set this value before redistribution using the `default-metric` command from within the `router rip` or `router ospf` contexts. This value is used for all types of redistributed routes, regardless of which protocol the route was learned from.

OSPF Dynamic Cost Support

An X330WAN OSPF interface can dynamically set a Cost. By default the OSPF interface Cost is calculated based on the interface bandwidth, according to the formula:

$$\text{Cost} = 100,000 / \text{bandwidth (in kbps)}$$

The result is that the higher the bandwidth, the lower the Cost.

To manually configure the Cost of the OSPF interface:

- Statically configure the Cost using the `ip ospf cost` command from the interface context. By using this option, no dynamic bandwidth updates can change the Cost. Return to dynamic cost calculation using the `no ip ospf cost` command.
- Manually set the bandwidth of the interface using the `bandwidth` command from within the Interface context. In this case, the configured bandwidth and not the actual interface bandwidth is taken into account when calculating the cost based on the above formula.

RIP Distribution Access Lists

RIP Distribution Access Lists consist of rules that specify how a router distributes and/or accepts RIP routing information from other routers. Before sending an update, the router consults an Access List to determine if it should include specific routes in the update. When receiving an update, the router first checks a set of rules which apply to incoming updates to determine if it should insert those routes into its routing table. You can assign the rules per interface and per direction.

Up to 99 RIP Distribution Access Lists can be configured on X330WAN.

For example: To configure a RIP Distribution Access List number 10 permitting distribution/learning of network 10.10.0.0:

- 1 Enter the command: **ip distribution access-list 10 1 permit 10.10.0.0 0.0.255.255**

The default action of the Access List is “deny” and can be changed by the **ip distribution access-default-action** command.



Note: Whenever at least one permit rule exists, distributing/learning of all the remaining networks are denied, unless specifically permitted by another rule.

- 2 Apply the Distribution List created in step 1 by performing the following procedure within the **router rip** context:
 - Enter the **distribution-list 10 in** command to apply list number 10 created in step 1 on all updates received on all interfaces.
 - Enter the **distribution-list 10 in FabricFastEthernet1** command to apply Access List 10 on updates received on interface ‘FabricFastEthernet1’.
 - Enter the **distribution-list 10 out** command to apply Access List 10 to all advertised updates.
 - Enter the **distribution-list 10 out ospf** command to apply Access List 10 to all advertised updates that were learned from OSPF (redistributed from OSPF into RIP).

If no Distribution Access List is defined, learning and/or advertising is allowed for all of the routing information. This is the default operation.

Fragmentation and Reassembly

X330WAN supports fragmentation of IP packets according to RFC 791, and reassembly of IP packets destined only to its interfaces.

Reassembly is associated with the following user-configurable parameters:

- **Fragment Size** - The maximum number of concurrently reassembled packets:
Range: 0-200; Default=100.
- **Fragment Timeout** - The maximum time, in seconds, to wait for a packet to be reassembled:
Range: 5-120; Default=10.
- **Fragment Chain** - The maximum number of fragments allowed per packet:
Range: 2-2048; Default=64.

To configure reassembly, use the following commands:

- **fragment size** Sets the maximum number of fragmented IP packets destined to the router that can be reassembled concurrently.
- **fragment chain** Sets the maximum number of fragments that can comprise a single IP packet destined to the router.
- **fragment timeout** Sets the maximum number of seconds to reassemble a fragmented IP packet destined to the router.
- **clear fragment** Sets the reassembly parameters to their defaults, as well as clears the reassembly database.
- **show fragment** Displays information regarding fragmented IP packets destined to the router (the status of the reassembly operation).

Configuring X330WAN to Connect Branch Offices to Headquarters

Many businesses have a centralized location for their headquarters and small branch offices. It is important that communication between the headquarters and the branches flows quickly. The following figure shows a typical configuration of the network connecting the headquarters with branch offices.



Note: The following example uses sample IP addresses for illustration only.

Figure 4.5 Connecting Branch Offices to Headquarters

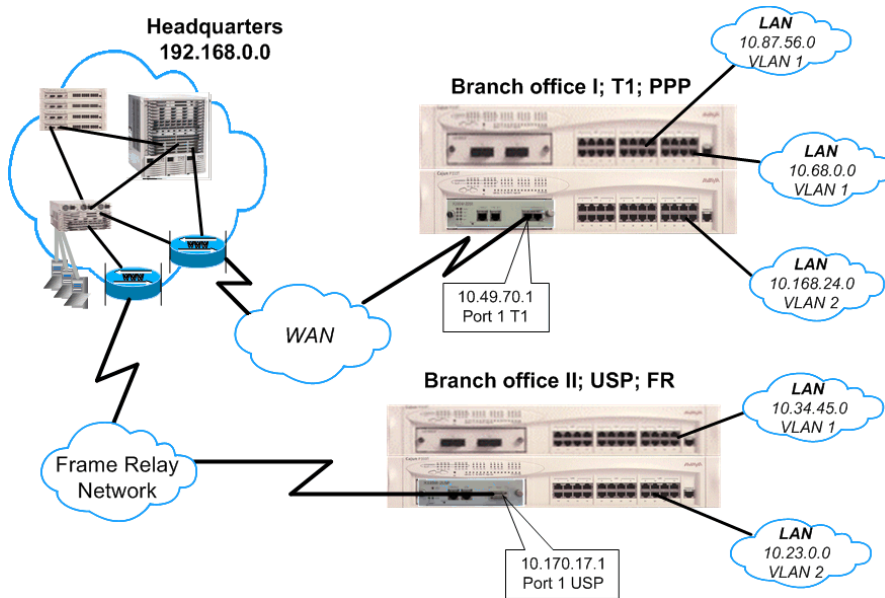


Figure 4.5 illustrates a configuration where two branch offices are connected to a headquarters office. Branch Office 1 is connected via a T1 connection with PPP encapsulation. Branch Office 2 is connected via a V.35 interface with Frame Relay encapsulation.

Following is the site-specific information:

- Headquarters:
 - Network 192.168.0.0 255.255.0.0
- Branch Office 1:
 - A stack of two P330 switches connected to three LANs.
 - A X330W-2DS1 module inserted into one of the P330 switches, configured for T1 with a WAN connection on port 1.
 - A Loopback 1 interface with an IP address 10.10.10.10 255.255.255.255
 - PPP encapsulation over a Channel Group of 4 Time-slots (1-4).
- Branch Office 2:
 - A stack of two P330 switches connected to two LANs.
 - An X330W-2USP module inserted into one of the P330 switches with a V.35 connection on port 1.
 - A Loopback 1 interface with an IP address 20.20.20.20 255.255.255.255
 - Frame Relay encapsulation on USP port 1.
 - Frame Relay Sub-interface 1 with DLCI 22.

Configuration Example for Branch Office 1

The following is the configuration procedure for the X330WAN in Branch Office 1, as shown in Figure 4.5:

```
X330WAN-2DS1-1(super)# interface Loopback 1
Done!
X330WAN-2DS1-1(super-if:Loopback1)# ip address 10.10.10.10 32
The Primary management interface has changed. Please copy the running
configuration to the start-up configuration file, and reset the WAN
router.
Done!
X330WAN-2DS1-1(super-if:Loopback1)# exit
X330WAN-2DS1-1(super)# copy running-config startup-config
X330WAN-2DS1-1(super)# reset
X330WAN-2DS1-1(super)# controller t1 1
Done!
X330WAN-2DS1-1(super-controller:1)# channel-group 1 timeslots 1-4
Done!
X330WAN-2DS1-1(super-controller:1)# exit
X330WAN-2DS1-1(super)# interface Serial 1:1
Done!
X330WAN-2DS1-1(super-if:Serial1:1)# ip address 10.49.70.1 24
Done!
X330WAN-2DS1-1(super-if:Serial1:1)# exit
X330WAN-2DS1-1(super)# interface FabricFastEthernet 1:1.1
Done!
X330WAN-2DS1-1(super-subif:FabricFastEthernet1:1.1)# ip address
10.87.56.1 24
Done!
X330WAN-2DS1-1(super-subif:FabricFastEthernet1:1.1)# exit
X330WAN-2DS1-1(super)# interface FabricFastEthernet 1:1.2
Done!
X330WAN-2DS1-1(super-subif:FabricFastEthernet1:1.2)# ip address
10.68.10.1 16
Done!
X330WAN-2DS1-1(super-subif:FabricFastEthernet1:1.2)# exit
X330WAN-2DS1-1(super)# interface FabricFastEthernet 1:2
Done!
X330WAN-2DS1-1(super-if:FabricFastEthernet1:2)# ip address
10.168.24.1 24
Done!
X330WAN-2DS1-1(super)# ip route 192.168.0.0 16 serial 1:1 permanent
Done!
```

Configuration Example for Branch Office 2

The following is the configuration procedure for the X330WAN in Branch Office 2, as shown in Figure 4.5:

```
X330WAN-2USP-1 (super) # interface Loopback 1
Done!
X330WAN-2USP-1 (super-if:Loopback1) # ip address 20.20.20.20 32
The Primary management interface has changed. Please copy the running
configuration to the start-up configuration file, and reset the WAN
router.
Done!
X330WAN-2USP-1 (super-if:Loopback0) # exit
X330WAN-2USP-1 (super) # copy running-config startup-config
X330WAN-2USP-1 (super) # reset
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:1
Done!
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1) # ip address
10.34.45.1 24
Done!
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1) # exit
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:2
Done!
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # ip address
10.23.10.1 16
Done!
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # exit
X330WAN-2USP-1 (super) # interface Serial 1
Done!
X330WAN-2USP-1 (super-if:Serial1) # encapsulation frame-relay
X330WAN-2USP-1 (super-if:Serial1) # exit
X330WAN-2USP-1 (super) # interface Serial 1.1 point-to-point
Done!
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay interface-dlci 22
Interface Serial 1.1 - DLCI 22 state changed to DELETED
Done!
X330WAN-2USP-1 (super-if:Serial1) # ip address 10.170.17.1 24
Done!
X330WAN-2USP-1 (super) # ip route 192.168.0.0 16 serial 1:1
Done!
```


Configuring the X330WAN for use with an External Firewall

There are different ways of connecting the X330WAN modules to provide security to the local network. Figure 4.6 shows a typical configuration where the WAN traffic goes through the X330WAN module out to an external firewall and/or VPN, and then enters the LAN.



Note: When connecting an external firewall/VPN to the Fast Ethernet port, disable the FabricFastEthernet interface using the **shutdown** command from within the **interface FabricFastEthernet1** context, to prevent a direct flow of packets from the WAN to the LAN.



Note: The following example uses sample IP addresses for illustration only.

Figure 4.6 X330WAN with Security

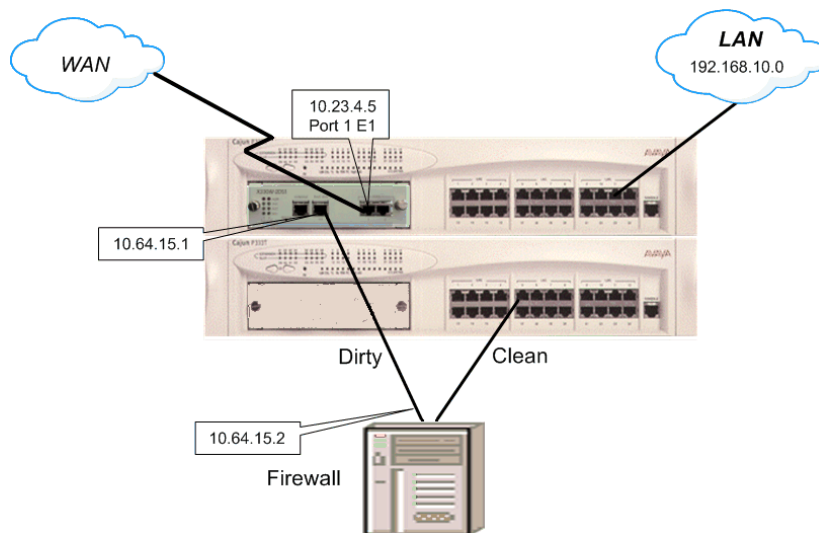


Figure 4.6 illustrates the X330W-2DS1 implementation connected with an external Firewall/VPN. The X330W-2DS1 is connected to the WAN with an E1 link to port 1. PPP encapsulation is configured over a Channel Group of 31 Time-slots (1-31). The “dirty” side of the external Firewall is connected to the X330W-2DS1 Fast Ethernet port, and the “clean” side is connected to the LAN. The X330W-2DS1’s FabricFastEthernet interface is disabled to prevent direct data flow from the WAN to the LAN.

The following is the configuration procedure for the X330WAN, as shown in Figure 4.6:

```
X330WAN-2DS1-1 (super) # interface Loopback 1
Done!
X330WAN-2DS1-1 (super-if:Loopback1) # ip address 10.10.10.10 32
The Primary management interface has changed. Please copy the running
configuration to the start-up configuration file, and reset the WAN
router.
Done!
X330WAN-2DS1-1 (super-if:Loopback1) # exit
X330WAN-2DS1-1 (super) # copy running-config startup-config
X330WAN-2DS1-1 (super) # reset
X330WAN-2DS1-1 (super) # controller e1 1
Done!
X330WAN-2DS1-1 (super-controller:1) # channel-group 1 timeslots 1-5
Done!
X330WAN-2DS1-1 (super-controller:1) # exit
X330WAN-2DS1-1 (super) # interface Serial 1:1
Done!
X330WAN-2DS1-1 (super-if:Serial1:1) # ip address 10.23.4.5 24
Done!
X330WAN-2DS1-1 (super-if:Serial1:1) # exit
X330WAN-2DS1-1 (super) # interface FastEthernet 1
Done!
X330WAN-2DS1-1 (super-if:FastEthernet1) # ip address 10.64.15.1 24
Done!
X330WAN-2DS1-1 (super-if:FastEthernet1) # exit
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1
Done!
X330WAN-2DS1-1 (super-if:FabricFastEthernet1) # shutdown
Interface FabricFastEthernet 1, changed state to administratively
down
Done!
X330WAN-2DS1-1 (super-if:FabricFastEthernet1) # exit
X330WAN-2DS1-1 (super) # ip route 192.198.10.0 24 10.64.15.2
Done!
```

Backup Interfaces

A Backup interface is activated when the Primary interface fails and is deactivated when the Primary interface is restored. You can configure Backup relations between a pair of any Layer 2 Serial interfaces. A PPP session, Frame Relay interface, and Frame Relay Sub-interface can serve as a Backup interface to any other Serial interface on a module level, including interfaces on different Serial ports.



Note: A Frame Relay interface in a Backup/Primary role overrides the role of its Sub-interfaces.

Configurable activation/deactivation delays provide a damping effect on the Backup interface pair. This eliminates Primary-Backup switching in case of fluctuating underlying Layer 2 interfaces. You can configure the following Backup delays:

- **Failure delay** - The time in seconds between the Primary interface going down and the Backup interface activation. Default = 0 seconds, maximum = 3600 seconds.
- **Secondary Disable delay** - The time in seconds between the Primary interface restoration and the Backup interface deactivation. Default = 0 seconds, maximum = 3600 seconds. Both interfaces are active during this time to enable a smooth transition for the routing protocols.



Note: You can also configure the X330WAN not to revert back to the Primary interface after it is restored.

The following rules govern the interface Backup relations:

- Each interface can have only one Backup interface.
- A Backup interface can serve as a backup for only one other interface.
- Only one member of a Primary-Backup pair is active at any given time. An interface is automatically deactivated when set as Backup.
- The Backup implementation does not protect against a double fault. Therefore, if a Backup interface fails while active, no switch to the Primary interface is attempted.

When using Frame Relay encapsulation, the Frame Relay interface is considered down when its primary DLCI is down. The switch over back to the main interface occurs when the primary DLCI is restored.



Note: The Backup interface is not activated when the Primary interface is Administratively disabled.

Use the following commands to configure Backup interfaces:

- **backup delay** Configures the Primary-Backup switchover delay.
- **backup interface** Configures a backup interface for a Primary interface. This command is used within the Primary interface's context.

Frame Relay Encapsulation

X330WAN supports the following Frame Relay QoS features:

- Priority DLCI
- Traffic Shaping and Marking per VC
- Priority queuing

These features and their implementation are described in the following sections.

To improve voice quality using cRTP, refer to the “Configuration tip” on page 54.

Priority DLCI

To implement new priority mechanisms, ISPs rely on new classes of service. Traffic types and users are divided into these classes and treated differently during peak periods. A premium, or first class user or traffic stream receives higher priority than a general user. This rating system ensures that the critical Internet user maintains peak performance, as well as provides a means for the ISPs to enhance the cost structure of network operations.

X330WAN supports Class-based traffic assignment, referred to as Priority DLCI. This separates traffic with different QoS levels to up to four different VCs on the same Frame-Relay sub-interface. This feature enables you to assign unique Permanent VCs (PVCs) for VoIP and non-VoIP traffic. You can set and adjust the priority using Policy. For more information, refer to "Policy" on page 48.

Configure the Priority DLCI using the **frame-relay priority-dlci-group** command in the serial sub-interface context. Specify the DLCIs in this command from the highest to lowest priority. If you specify less than four DLCIs, the last DLCI specified is automatically used for the missing priorities.



Note: When using Priority DLCI, the primary DLCI is used to determine the state of the Sub Frame Relay interface: when the primary DLCI is up, the Sub Frame Relay interface is up, and when the primary DLCI is down, the Sub Frame Relay interface is down. When using Priority DLCI, it is therefore recommended to verify that the primary DLCI is set as the High Priority DLCI in the Priority DLCI group.



Note: In X330WAN, OSPF is mapped by default to the High Priority DLCI. For better network reliability, it is recommended to verify that the same configuration exists on the other side of the Frame Relay connection.



Note: If one of the priority DLCIs is down, its traffic is dropped.



Note: Map the PVC control protocol on the routers at all ends of a multi-VC point-to-point link. Map this VC to the highest priority DLCI.

Traffic Shaping and Marking

The policing function estimates the parameters of the incoming traffic and takes action if it measures traffic exceeding agreed parameters. This action could be to drop the packets, mark them as being high-drop priority, etc.

X330WAN supports the following Traffic Shaping parameters per PVC:

- **CIR** - Committed Information Rate
- **DE pre-mark** - Enables marking certain packets as Discard Eligible (DE).
- **Link Fragmentation and Interleaving (LFI)** - Enables fragmentation of large Frame Relay frames per PVC.

You configure the Traffic Shaping parameters within Map Classes. A Map Class is comprised of the following parameters:

- **CIR** - Default = 56,000bps
- **BC** - Committed Burst size, default = 7,000 bps
- **BE** - Excess Burst size, default = 0 bps
- **DE-premark** - Specifies the amount of non-high priority (0-5) packets over the BC and under the BE to label as DE. This amount is measured in percentage of CIR. The default is 100%, unconditionally dropping all packets above the BE.
- **Fragmentation** - Fragment size, in bytes. The default is No Fragmentation.

You can configure up to 128 different Map Classes using different combinations of Traffic Shaping parameters. You then apply these Map Classes to either the Primary VC or to the priority-DLCI group VCs.



Note: You must configure the Primary VC before associating a DLCI Map Class to the priority-DLCI group VCs. Removing the Primary VC after associating a DLCI Map Class to the priority-DLCI group VCs, removes their Map Class configuration.

Enable Traffic Shaping on a Frame Relay interface using the **frame-relay traffic-shaping** command. After you enable Traffic Shaping, a default Map Class is applied to all PVC currently configured. In this default Map Class, the BE = 0, causing all traffic above the BC to be dropped.

Priority Queuing

Priority Queuing is designed to give all mission-critical programs higher priority than less critical traffic. Traffic is queued as high, normal, medium, or low. Using Priority Queuing, all high-priority traffic is serviced first, then normal, etc.

The Frame Relay ingress queuing mechanism functions the same as on PPP interfaces, described in "QoS Implementation for PPP Encapsulation" on page 55. The Frame Relay egress queuing mechanism also functions the same as on PPP interfaces, serving all PVCs configured on the interface, with an additional user-configurable DE buffer. The DE buffer contains all traffic marked as Discard Eligible, and has the lowest priority.

When using VoIP, X330WAN enables a distinction within the High-priority queue between priorities 6 and 7. X330WAN uses priority 6 for the voice-bearer traffic, and priority 7 for the voice-controller traffic. These two priorities are served on a Round-Robin basis. Within the High-priority queue the priority 6 (voice-bearer) capacity is a maximum of 25% the size of the priority 7 (voice-controller) capacity to reduce the delay of voice flow. The priority 6-7 distinction exists in Data mode as well, where the queue is divided equally between both capacities.

Policy

X330WAN Policy concept allows you to:

- Change the packet's Layer 2 Priority, thereby affecting the traffic's QoS.
- Perform the "drop", "drop and notify", and "permit" Access Control actions.
- Change the DSCP value in the IP header of the packet (DSCP coloring).

A Policy list contains:

- A set of classification rules based on a source IP, destination IP, source port, destination port, protocol, and TCP Established bit. The IP addresses can include wildcards.
- A set of DSCP-802.1p mappings.
- A list of possible Policy actions arranged in a Composite Operations Table.

X330WAN allows for up to 20 concurrent active Policy lists on all of the interfaces. You can set a Policy list per interface and per direction, meaning each interface can have an ingress and egress active Policy list. On the FabricFastEthernet port, a Policy list applies to all of the configured VLANs. A Policy list in X330WAN can include QoS and Access Control rules.

In addition to the rules, each Policy list includes a DSCP-802.1p mapping table. You can specify the Layer 2 Priority for forwarding the packet, based on the packet's IP header DSCP field. When no Policy rules are configured, or when the outcome of a Policy rule is "permit", the DSCP-802.1p mapping table is consulted to verify whether the packet priority should be changed. In this case, you can configure whether to use the mapping table and change the priority accordingly, or to leave the original 802.1p priority (trust CoS).

The third element of the X330WAN Policy list is the Composite Operations Table, illustrated in Figure 4.7. The Composite Operations Table defines the operations applied to a packet, when the packet matches a Policy rule or a specific DSCP value. The Policy rules action and the DSCP mapping table point to an entry in the Composite Operations Table. The Composite Operations Table includes a default list of all of the possible priority modification and Access Control actions. You can create more entries in the Composite Operation Table using the X330WAN CLI commands presented on page 50, and described in Chapter 6: *X330WAN CLI Commands*. Each entry in the Composite Operation Table is composed of a combination of different available Policy operations, such as Access Control, Priority, and DSCP.

Figure 4.7 Default Composite Operations Table

Op	Name	Access	Notify	Priority	DSCP	Valid-Data
0	fwd0	forward	no trap	fwd0	no change	valid
1	fwd1	forward	no trap	fwd1	no change	valid
2	fwd2	forward	no trap	fwd2	no change	valid
3	fwd3	forward	no trap	fwd3	no change	valid
4	fwd4	forward	no trap	fwd4	no change	valid
5	fwd5	forward	no trap	fwd5	no change	valid
6	fwd6	forward	no trap	fwd6	no change	valid
7	fwd7	forward	no trap	fwd7	no change	valid
9	permit	forward	no trap	no-change	no change	valid
10	deny	deny	no trap	no-change	no change	valid
11	deny-and-notify	deny	send trap	no-change	no change	valid

For example: The Policy rule `ip access-list 100 1 fwd3 tcp any any` points to entry number 3 in the Composite Operations Table based on the action name - `fwd3`. The resulting action is the combination of all the relevant operations in this entry, meaning the packet is forwarded, no traps are issued, the packet's priority is changed to 3, and 'no' DSCP modification occurs.

Since the predefined entries in the Composite Operations Table include all of the available priority modification and Access Control actions, the only time you need to add entries to this table is for DSCP coloring.

For example: To set the DSCP value to 45 for all of the UDP traffic:

- 1 Create a new entry in the Composite Operations Table with the name 'cngdscp' (or any other name) by entering:

```
ip composite-op name 100 15 cngdscp
```

Where 100 is the Policy list number, and 15 is the number of the created entry in the Composite Operations Table.

- 2 Set the DSCP value to 45 by entering: `ip composite-op dscp 100 15 45`
Where 100 is the Policy list number, and 15 is the number of the created entry in the Composite Operations Table.

- 3 Create the following Policy rule:

```
ip access-list 100 1 cngdscp udp any any
```

Since the action part of the Policy rule has a value of `cngdscp`, this value is searched for in the Composite Operations Table, and the associated actions in the Composite Operations Table are applied to the packet. In this case, the DSCP is changed to 45.

- 4 Activate the new Access List created on a required interface using the `ip access-group` command in the interface's context.

For example: entering `ip access-group 100 in` within the Serial 1 interface context activates Access List 100 on the ingress of the Serial 1 interface.

In a similar manner, the DSCP-802.1p mapping table can point to an entry in the Composite Operations Table, causing the action of a particular DSCP value not to be a 802.1p Priority, but rather the value of the referenced entry in the Composite Operations Table.

The following Policy commands are performed outside a context:

- `[no] ip access-list` Creates/deletes a policy statement.
- `ip access-default-action` Sets the default action for a specific Policy list.
- `ip access-list-name` Sets the name for the Policy list.
- `ip access-list-owner` Sets the owner for the Policy list.
- `ip access-list-cookie` Sets the Policy list cookie.
- `ip access-list-copy` Copies a Policy list.

- **ip access-list-dscp operation** Specifies the action to be mapped to a DSCP value.
- **ip access-list-dscp trust** Configures the trusted entity.
- **ip access-list-dscp precedence** Sets the DSCP precedence.
- **ip access-list-dscp name** Sets the DSCP name.
- **set qos policy-source** Sets the Policy source.
- **no ip composite-op** Deletes a composite operation from the Composite Operations Table.
- **ip composite-op notify** Sets the trap mode of a composite operation in a Policy list.
- **ip composite-op dscp** Sets the DSCP value of a Policy operation.
- **ip composite-op access** Sets the access value of a Policy operation.
- **ip composite-op priority** Sets the Layer 2 priority of a Policy operation.
- **ip composite-op name** Sets the name of a Policy operation.

The following policy commands are performed within an Interface context:

- **[no] ip access-group** Activates a specific Policy list/suspends a current Policy list.
- **ip simulate** Applies Policy to a simulated packet.
- **validate-group** Validates a Policy list.

To display the Policy configuration, use the following commands:

- **show access-group** Displays information about configured access groups.
- **show ip access-lists** Displays all Policy lists and their rules (without any validation status).
- **show ip access-lists details** Displays all Policy lists and their rules (without any validation status), and displays the DSCP table and the Composite Operation Table.
- **show ip access-list-dscp** Displays the DSCP table of a given Policy list.
- **show ip access-list-summary** Displays a summary of all Policy lists.

- **show ip composite-op** Displays a composite operation of a Policy list.
- **show ip active-access-groups** Displays the active Policy list for each context/direction.

Controlling Network Access to the X330WAN

X330WAN enables you to control access to its router interfaces using the “single point of presence” characteristics of the Layer 2 Loopback interface. This is an alternative to configuring Access Control rules separately on each router interface. By activating Access Control rules on a Loopback interface, you can control all traffic entering and leaving the X330WAN’s CPU. Different Access Lists can be configured on the “Loopback in” and “Loopback out” interfaces.



Note: A Policy list activated on a Loopback interface applies only to packets destined to the router interface, and not to packets routed by the CPU.

For example: An Access Control rule denying Telnet sessions placed on the Loopback interface prevent Telnet access to the CPU, thus preventing any configuration changes to the module. This rule does not prevent Telnet sessions between any two users connected to the X330WAN interfaces.

Perform the following to activate such a Policy list on the Loopback interface using the CLI:

- 1 Create an Access Control List by entering: **ip access-list 101 1 deny tcp any any eq 23**
Where 101 is the Access list number, 1 is the number of the Rule in the list, Deny is the action, and 23 is the tcp Telnet port number.
- 2 Type **interface Loopback 1** to enter the Loopback1 interface.
- 3 Use the **ip access-group 101 in** command to activate the new Access Control list created in step 1 on the ingress direction of the Loopback1 interface.



Note: In order to apply an Access Control List to the router interfaces, the Policy should be applied on Loopback1 interface (**interface loopback1**). If additional Loopback interfaces have been created, applying Policy on them does not take affect. No CLI message informs you of this during the configuration.

RTP Header Compression (cRTP)

Real Time Protocol (RTP) is the basis of common VoIP traffic. RTP runs over UDP, and incurs a 12-byte header on top of other (IP, UDP) headers. Running on PPP or Frame-Relay, this protocol can be compressed.

The X330WAN RTP Header Compression process is based on the following facts:

- The packet order on a PPP and Frame Relay link is preserved.
- After transmitting full headers usually only the “deltas” from the full packet’s header need to be sent, and not the full header itself. This is due to the IP, UDP, and RTP header structure.
- Since the “deltas” are often constant, the second order “delta” is then 0 and does not need to be transmitted.

You can configure how often the full header is transmitted, either as a function of time or transmitted compressed packets.

RTP Header Compression can reduce the size of all three headers (IP+UDP+RTP~40 bytes) to 2-4 bytes.

X330WAN can compress only RTP packets. Any UDP packet with an even destination port within a user-configurable range of ports, is considered an RTP packet.

X330WAN can decompress any type of compressed packets. Decompression is enabled whenever the RTP compression is enabled. By default, X330WAN decompresses up to 16 compressed TCP connections. You can modify this number (within the range of 3-256) using the **ip tcp decompression-connections** command.



Note: When the device on the other end is a non-Avaya device:

- Configure the port range of the Avaya device to 49152 - 65535 using the **ip rtp port-range** command. Ensure that your voice application (i.e., the Avaya DEFINITY Communication Server) is using the same port range.
 - Configure the maximum number of connections to 255 using the **ip rtp compression-connections** command.
 - Verify that you are working in the `non-ietf` working mode. This mode is the default cRTP operational mode of X330WAN. You can change this mode using the **ip rtp non-tcp mode** command.
-

**Note: When the device on the other end is an Avaya device:**

- Configure the port range of both X330WANs to the same range using the **ip rtp port-range** command. Verify that your voice application (the Avaya DEFINITY Communication Server) is configured to the same port range.
 - Configure both X330WANs to the **ietf** mode using the **ip rtp non-tcp mode** command.
-



Note: In order to verify that the number of concurrent compressed TCP connections is the same in X330WAN and in the router connected on the other side of the WAN, use the **ip tcp decompression-connections** command. This command ensures decompression of TCP packets compressed by both routers.

Configuration tip: To obtain better voice quality when using cRTP, set the VoIP queue size to twice its original size. To perform this, do the following:

- 1 Set the VoIP mode using the **voip-queue** command within the specific Serial interface context.
- 2 Exit the Serial interface context.
- 3 Obtain the current VoIP queue size using the **show queuing** command. The VoIP queue is the “Queue 1 (High)”.
- 4 Set the VoIP queue to twice the current size using the **queue-limit** <queue id> <size> command within the previous Serial interface context, where queue id = 1 and size is twice the original value.

To configure RTP header compression, use the following commands:

- **ip rtp header-compression** Enables compressing outgoing RTP packets.
- **ip rtp compression-connections** Changes the number of connections the interface accepts for RTP compression.
- **ip rtp max-period** Sets the maximum number of compressed packets sent between two full header packets.
- **ip rtp max-time** Sets the maximum number of seconds between transmission of two full header packets.
- **ip rtp port-range** Sets the RTP port numbers range.
- **ip rtp non-tcp-mode** Sets the non-tcp decompression mode.
- **show ip rtp header-compression** Displays the active RTP compression parameters.

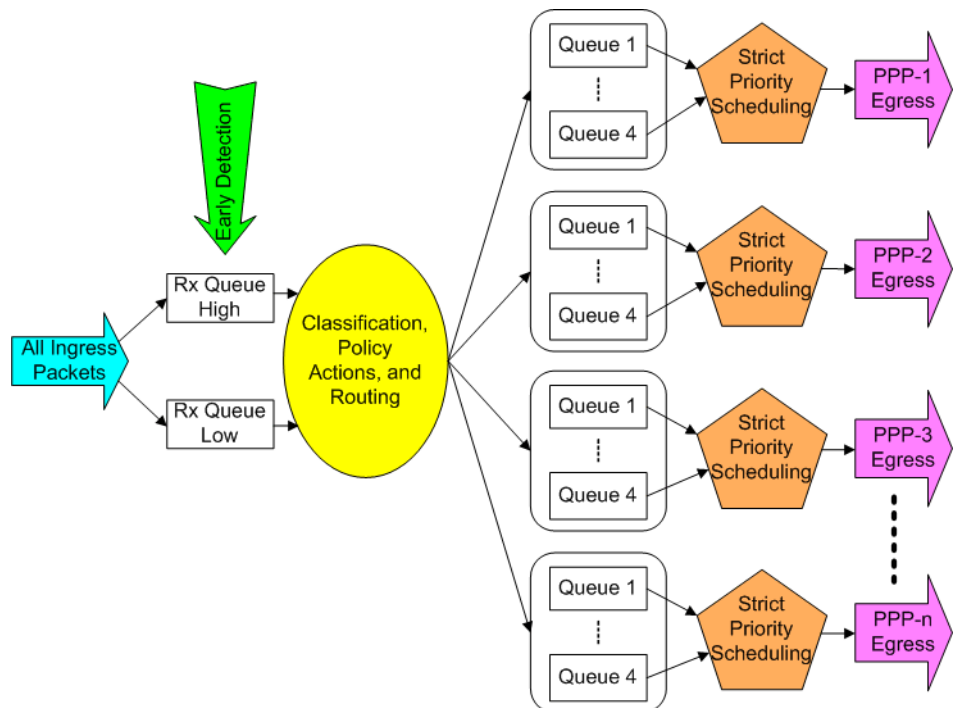
QoS and VoIP Treatment

X330WAN enforces QoS on the ingress and egress flows. QoS implementation depends on the X330WAN encapsulation method, described below.

QoS Implementation for PPP Encapsulation

Incoming packets to X330WAN are classified and queued in one of the two available Rx queues. Separation is performed on packets to be transmitted on a per-interface basis, with four queues servicing each serial interface. The general X330WAN QoS concept is shown in Figure 4.8.

Figure 4.8 QoS Queues



As illustrated in Figure 4.8, incoming packets are classified into two queues where Weighted Random Early Detection (WRED) is implemented on the packets. WRED serves as a flow control mechanism, enabling the sending TCP peer to adjust its transmission rate based on the X330WAN average ingress queue congestion.

The usual queuing mechanism begins dropping all packets without previous warning when the queue becomes completely congested. As opposed to this the WRED mechanism ensures a gradual increase in the probability of a packet being dropped based on the queue congestion at any given moment. This gradual increase

enables the TCP Sliding Window mechanism on the sending peer to adjust the window size accordingly, thereby reducing the transmission rate and ultimately reducing the congestion on the X330WAN Rx queues.



Note: WRED is an automatic process and is always enabled. WRED does not include any user-configurable parameters.

The ingress packets exit the queues based on strict priority scheduling. Upon exiting, they are subject to Layer 3 manipulation (routing, Policy-based modification, etc.). The packets are then inserted into one of the four Tx queues per egress Serial interface based on their 802.1p priority. WRED is implemented on the Tx queues similar to the Rx queues. On each Serial interface the packets are transmitted to the line based on strict-priority scheduling between the four queues. Since WAN traffic can carry data and voice, a means of setting priorities for different types of traffic is required. The X330WAN QoS mechanism on the Serial interfaces operates in the following modes:

- **Data mode** - Provides no voice support. This is the default mode.
- **VoIP mode** - Gives precedence to VoIP traffic, while still processing data traffic on the lower priorities.

The mode type is configurable using the **(no) voip-queue** command.

Data Mode

The incoming packets are categorized into the following Rx queues:

- **High priority queue** - All packets entering via the Serial interface, and LAN Ethernet packets with 802.1p priority 4-7.
- **Low priority queue** - All packets entering via the Fast Ethernet port, and LAN Ethernet packets with 802.1p priority 0-3.

You can prioritize traffic entering on the Fast Ethernet and FabricFast Ethernet interfaces based on the packet's DSCP value. You prepare a Policy List which maps the packet's DSCP value to the 802.1p priority. You then need to activate this new policy list on the ingress direction of either the Fast Ethernet or FabricFast Ethernet interface. The packet's priority is now changed according to the DSCP value in the incoming packet's IP header. When using this method, choose the list's trust to be either DSCP or CoS-DSCP. For more information, refer to "Policy" on page 48.

X330WAN automatically sets the size of the four Tx queues based on the interface bandwidth and the Maximum Transmission Unit (MTU) configured by the user. The default queue size allows a maximum two second delay. The categorization of data into the four Tx queues is based on packet priority. All queues implement head-drop when overflowed, as shown in Figure 4.9 on page 57.

VoIP Mode

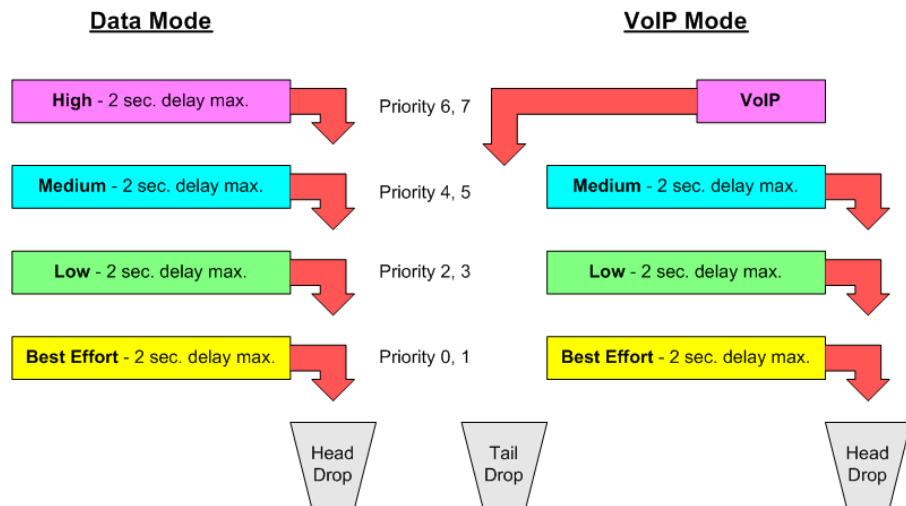
The incoming packets are categorized into the Rx queues as in the Data mode.

The size of each of the four Tx queues is automatically set by X330WAN as follows:

- **Highest priority queue (VoIP)** - Set by default to a maximum delay of 20 milliseconds, optimized for a G.729 voice CODEC (without cRTP), and implements tail-drop when overflowed. This queue is divided into two priorities, 6 and 7, which are treated differently to improve distinction between the Voice Bearer (RTP) (priority 6) and Voice Control (priority 7) packets. The two priorities are serviced in a Round-Robin one-to-one fashion, where the priority 6 (RTP) buffer is 25% the size of the priority 7 (Voice Control) buffer to reduce the delay in VoIP flow. The priority 6-7 distinction exists in Data mode as well, where the queue is divided equally between both capacities.
- The remaining queues are set using the same methods as in Data mode.

Figure 4.9 illustrates the queue and overflow concept for the Data and VoIP modes.

Figure 4.9 Default QoS Behavior



Note: You can adjust the queue length in both modes for different needs. Queue length should always be kept as small as possible, while still maintaining a flow. It is recommended to always use the default queue length, as this is the optimal calculated length. To adjust the queue length in both modes, use the **queue-limit** command.



Note: By default, Avaya IP phones have the DSCP value configured to 46 and do not tag packet priority. To enable such packets to reach the VoIP queue, they should be tagged with a priority of 6. To achieve this, either set the IP phone to Tagging Mode, or use an appropriate DSCP-802.1p mapping in X330WAN. For more information, refer to "Policy" on page 48.

To improve voice quality using cRTP, refer to the "Configuration tip" on page 54.

VoIP Implementation with a G700 Media Gateway and an S8300 Media Server

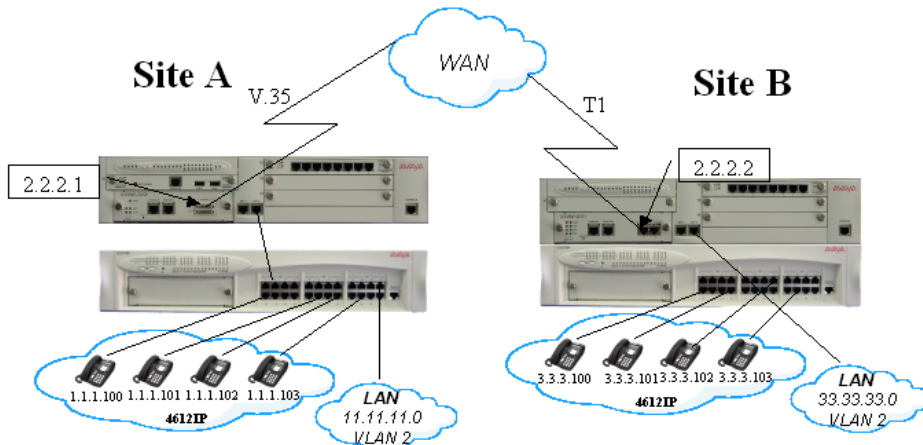
This section contains the following VoIP implementation configuration examples:

- Figure 4.10 below illustrates a common PPP VoIP configuration between two sites connected over a WAN.
- Figure 4.11 on page 63 illustrates a common Frame Relay VoIP configuration between two sites connected over a WAN.

PPP VoIP Configuration

Figure 4.10 illustrates a common PPP VoIP configuration between two sites connected over a WAN.

Figure 4.10 PPP VoIP Configuration



In Figure 4.10, Site A contains four IP phones and a data LAN connected via a P333T-PWR switch to a S8300 Media Server. The S8300 Media Server houses a X330W-2USP expansion module that is connected to the WAN via a 128Kbps V.35 interface. Following are the connection details for Site A:

- The IP phones are configured with the following DSCP tagging:
 - Voice = DSCP 46
 - Voice control = DSCP 34



Note: The Policy list in the next configuration is based on the assumption that the Media Gateway, Media Server, and the IP phones send VoIP control packets with a DSCP value of 34 and voice with a DSCP value of 46. If any of the components of the topology are sending control or voice packets with other DSCP values, you must make changes in the Policy list.

- The S8300 Media Server default RTP UDP port range is 2048 to 3028.
- Network IPs (all 24 mask):
 - IP phones - 1.1.1.0 (VLAN 1)
 - Data - 11.11.11.0 (VLAN 2)
 - Serial - 2.2.2.1
 - Gatekeeper - 149.49.54.81
 - MGP - 149.49.54.82
 - VoIP (MGP) - 149.49.54.83

Site B contains four IP phones and a data LAN connected to a P333T-PWR switch in a stack with a G700 Media Gateway. The G700 Media Gateway houses a X330W-2DS1 expansion module that is connected to the WAN via a two-timeslot (128Kbps) T1 interface. Following are the connection details for Site B:

- IP phone are configured with DSCP tagging:
 - Voice = DSCP 46
 - Voice control = DSCP 34
- The G700 Media Gateway default RTP UDP port range is 2048 to 3028.
- Network IPs (all 24 mask):
 - IP phones - 3.3.3.0 (VLAN 1)
 - Data - 33.33.33.0 (VLAN 2)
 - Serial - 2.2.2.2
 - MGP - 4.4.4.10
 - VoIP (MGP) - 4.4.4.11

Configuration Example for Site A

The following is the configuration procedure for the X330WAN-2USP, as shown in Figure 4.10. Commands with footnotes are described at the end of the configuration procedure.

- Loopback and PMI interfaces configuration:

```
X330WAN-2USP-1 (super) # interface Loopback 1
X330WAN-2USP-1 (super-if:Loopback1) # ip address 10.10.10.10 24
```

The Primary management interface has changed. Please copy the running configuration to the start-up configuration file, and reset the device.

```
X330WAN-2USP-1 (super-if:Loopback1) # exit
X330WAN-2USP-1 (super) # copy running-config startup-config
X330WAN-2USP-1 (super) # reset
```

- FabricFastEthernet interface configuration:

```
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:1
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1) # ip address 1.1.1.1 24
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1) # exit
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:1.1
X330WAN-2USP-1 (super-subif:FabricFastEthernet1:1.1) # ip address 149.49.54.80 24
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1.1) # exit
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:2
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # ip address 11.11.11.1 24
```

```
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # exit
```

- Configuration of a Policy list with the appropriate DSCP-CoS mappings:

```
X330WAN-2USP-1 (super) # set qos policy-source local
X330WAN-2USP-1 (super) # ip access-list-name 100 voice
X330WAN-2USP-1 (super) # ip access-list-dscp operation 100 34 fwd7 (1)
X330WAN-2USP-1 (super) # ip access-list-dscp operation 100 46 fwd6 (2)
X330WAN-2USP-1 (super) # ip access-list-dscp trust 100 trust-cos-dscp (3)
```

- Activating the Policy List on the FabricFastEthernet interface:

```
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1
X330WAN-2USP-1 (super-if:FabricFastEthernet1) # ip access-group 100 in
X330WAN-2USP-1 (super-if:FabricFastEthernet1) # exit
```

- Serial interface configuration:

```
X330WAN-2USP-1 (super) # interface Serial 1
X330WAN-2USP-1 (super-if:Serial1) # ip address 2.2.2.1 24
X330WAN-2USP-1 (super-if:Serial1) # mtu 300
```



Note: Some LAN data applications do not support fragmented packets. In this case, do not change the MTU from its default of 1500.

```
X330WAN-2USP-1(super-if:Serial1)# bandwidth 128
• VoIP configuration:
X330WAN-2USP-1(super-if:Serial1)# voip-queue
X330WAN-2USP-1(super-if:Serial1)# ip rtp header-compression
X330WAN-2USP-1(super-if:Serial1)# ip rtp compression-connections 20(4)
X330WAN-2USP-1(super-if:Serial1)# ip rtp port-range 2048 3028 (5)
X330WAN- 2USP-1(super-if:Serial1:1)# queue-limit 1 12 (6)
X330WAN-2USP-1(super-if:Serial1)# exit
• Static routes configuration:
X330WAN-2USP-1(super)# ip default-gateway 2.2.2.2
X330WAN-2USP-1(super)# ip route 3.3.3.0 24 serial 1
X330WAN-2USP-1(super)# ip route 33.33.33.0 24 serial 1
```

* Description of footnoted commands (also applies to identical stages in configuring Site B):

- (1) At this stage you apply Priority 7 to Voice Control traffic.
- (2) At this stage you apply Priority 6 to RTP traffic.
- (3) At this stage you apply maximum trust between 802.1p priority and DSCP.
- (4) At this stage the number of connections (20) depends on the number of phones.
- (5) At this stage you are matching the RTP port range to that of the G700.
- (6) At this stage the default queue size is 6, and since cRTP is enabled you can double the VoIP queue size.

Configuration Example for Site B

The following is the configuration procedure for the X330WAN-2DS1, as shown in Figure 4.10:

```
• Loopback and PMI interfaces configuration:
X330WAN-2DS1-1(super)# interface Loopback 1
X330WAN-2DS1-1(super-if:Loopback1)# ip address 20.20.20.20 32
The Primary management interface has changed. Please copy the running
configuration to the start-up configuration file, and reset the
device.
X330WAN-2DS1-1(super-if:Loopback1)# exit
X330WAN-2DS1-1(super)# copy running-config startup-config
X330WAN-2DS1-1(super)# reset
```

- - FabricFastEthernet interface configuration:

```
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1:1
X330WAN-2DS1-1 (super-if:FabricFastEthernet1:1) # ip address
3.3.3.1 24
X330WAN-2DS1-1 (super-if:FabricFastEthernet1:1) # exit
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1:1.1
X330WAN-2DS1-1 (super-subif:FabricFastEthernet1:1.1) # ip address
4.4.4.1 24
X330WAN-2DS1-1 (super-subif:FabricFastEthernet1:1.1) # exit
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1:2
X330WAN-2DS1-1 (super-if:FabricFastEthernet1:2) # ip address
33.33.33.1 24
```

- Configuration of a Policy list with the appropriate DSCP-CoS mappings:

```
X330WAN-2DS1-1 (super) # set qos policy-source local
X330WAN-2DS1-1 (super) # ip access-list-name 100 voice
X330WAN-2DS1-1 (super) # ip access-list-dscp operation 100 34 fwd7
X330WAN-2DS1-1 (super) # ip access-list-dscp operation 100 46 fwd6
X330WAN-2DS1-1 (super) # ip access-list-dscp trust 100 trust-cos-dscp
```

- Activating the Policy List on the FabricFastEthernet interface:

```
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1
X330WAN-2DS1-1 (super-if:FabricFastEthernet1) # ip access-group 100 in
X330WAN-2DS1-1 (super-if:FabricFastEthernet1) # exit
```

- Serial interface configuration:

```
X330WAN-2DS1-1 (super) # controller t1 1
X330WAN-2DS1-1 (super-controller:1) # channel-group 1 timeslots 1-2
speed 64
X330WAN-2DS1-1 (super-controller:1) # exit
X330WAN-2DS1-1 (super) # interface Serial 1:1
X330WAN-2DS1-1 (super-if:Serial1:1) # ip address 2.2.2.2 24
X330WAN-2DS1-1 (super-if:Serial1:1) # mtu 300
```



Note: Some LAN data applications do not support fragmented packets. In this case, do not change the MTU from its default of 1500.

- VoIP configuration:

```
X330WAN-2DS1-1 (super-if:Serial1:1) # voip-queue
X330WAN-2DS1-1 (super-if:Serial1:1) # ip rtp header-compression
X330WAN-2DS1-1 (super-if:Serial1:1) # ip rtp compression-connections
20
X330WAN-2DS1-1 (super-if:Serial1:1) # ip rtp port-range 2048 3028
```

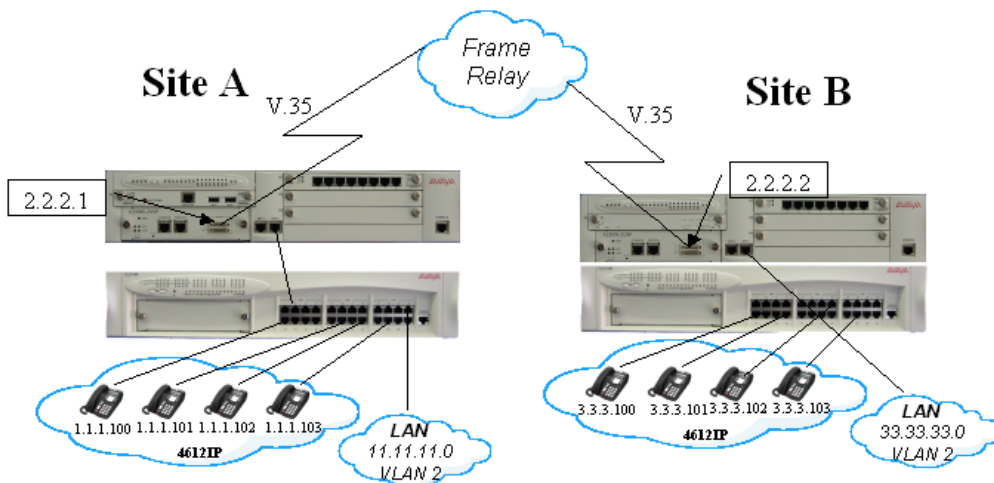
```
X330WAN-2DS1-1(super-if:Serial1:1)# queue-limit 1 12
X330WAN-2DS1-1(super-if:Serial1:1)# exit
• Static routes configuration:
X330WAN-2DS1-1(super)# ip route 1.1.1.0 24 serial 1:1
X330WAN-2DS1-1(super)# ip route 11.11.11.0 24 serial 1:1
```

Frame Relay VoIP Configuration

Figure 4.11 illustrates a common Frame Relay VoIP configuration between two sites connected over a WAN. The following configuration scenarios are provided below that relate to this illustration:

- Traffic Shaping - A single VC between Site A and Site B.
- Priority DLCI and Traffic Shaping - Two VCs between Site A and Site B.

Figure 4.11 VoIP Configuration with Frame Relay Encapsulation



Scenario 1 - Traffic Shaping

In Figure 4.11, Site A contains four IP phones and a data LAN connected via a P333T-PWR switch to a S8300 Media Server. The S8300 Media Server houses an X330W-2USP expansion module that is connected to a Frame Relay network via a 192Kbps Frame Relay encapsulated V.35 interface. Following are the connection details for Site A:

- A single VC with:
 - CIR = 128Kbps
 - DLCI = 16

- The IP phones are configured with the following DSCP tagging:
 - Voice = DSCP 46
 - Voice control = DSCP 34
- Network IPs (all 24 mask):
 - IP phones - 1.1.1.0 (VLAN 1)
 - Data - 11.11.11.0 (VLAN 2)
 - Serial - 2.2.2.1
 - Gatekeeper - 149.49.54.81
 - MGP - 149.49.54.82
 - VoIP (MGP) - 149.49.54.83

Site B contains four IP phones and a data LAN connected to a P333T-PWR switch in a stack with a G700 Media Gateway. The G700 Media Gateway houses an X330W-2USP expansion module that is connected to a Frame Relay network via a 192Kbps Frame Relay encapsulated V.35 interface.

Following are the connection details for Site B:

- A single VC with:
 - CIR = 128Kbps
 - DLCI = 16
- The IP phones are configured with DSCP tagging:
 - Voice = DSCP 46
 - Voice control = DSCP 34
- Network IPs (all 24 mask):
 - IP phones - 3.3.3.0 (VLAN 1)
 - Data - 33.33.33.0 (VLAN 2)
 - Serial - 2.2.2.2
 - MGP - 4.4.4.10
 - VoIP (MGP) - 4.4.4.11

Configuration Example 1 for Site A - Single VC Between Sites

Following is the configuration procedure for the X330WAN-2USP, as shown in Figure 4.11. Commands with footnotes are described at the end of the configuration procedure.

- Loopback and PMI interfaces configuration:

```
X330WAN-2USP-1 (super) # interface Loopback 1
```

```
X330WAN-2USP-1 (super-if:Loopback1) # ip address 10.10.10.10 24
```

The Primary management interface has changed. Please copy the running configuration to the start-up configuration file, and reset the device.

```
X330WAN-2USP-1 (super-if:Loopback1) # exit
```

```
X330WAN-2USP-1 (super) # copy running-config startup-config
```

```
X330WAN-2USP-1 (super) # reset
```

- FabricFastEthernet interface configuration:

```
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:1
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1) # ip address 1.1.1.1
24
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1) # exit
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:1.1
X330WAN-2USP-1 (super-subif:FabricFastEthernet1:1.1) # ip address
149.49.54.80 24
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1.1) # exit
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:2
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # ip address
11.11.11.1 24
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # exit
```

- Configuration of a Policy list with the appropriate DSCP-CoS mappings:

```
X330WAN-2USP-1 (super) # set qos policy-source local
X330WAN-2USP-1 (super) # ip access-list-name 100 voice
X330WAN-2USP-1 (super) # ip access-list-dscp operation 100 34 fwd7
X330WAN-2USP-1 (super) # ip access-list-dscp operation 100 46 fwd6
X330WAN-2USP-1 (super) # ip access-list-dscp trust 100 trust-cos-dscp
```

- Activating the Policy List on the FabricFastEthernet interface:

```
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1
X330WAN-2USP-1 (super-if:FabricFastEthernet1) # ip access-group 100 in
X330WAN-2USP-1 (super-if:FabricFastEthernet1) # exit
```

- Map-class configuration:

```
X330WAN-2USP-1 (super) # map-class frame-relay voip
X330WAN-2USP-1 (super-map-class) # cir out 128000 (1)
X330WAN-2USP-1 (super-map-class) # be out 8000 (2)
X330WAN-2USP-1 (super-map-class) # bc out 16000 (3)
X330WAN-2USP-1 (super-map-class) # de pre-mark 80 (4)
X330WAN-2USP-1 (super-map-class) # fragment (5)
X330WAN-2USP-1 (super-map-class) # exit
```

- Serial interface configuration

```
X330WAN-2USP-1 (super) # interface Serial 1
X330WAN-2USP-1 (super-if:Serial1) # encapsulation frame-relay
X330WAN-2USP-1 (super-if:Serial1) # bandwidth 192
X330WAN-2USP-1 (super-if:Serial1) # frame-relay traffic-shaping
X330WAN-2USP-1 (super-if:Serial1) # voip-queue
X330WAN-2USP-1 (super-if:Serial1) # exit
```

- Frame relay sub interface configuration:

```
X330WAN-2USP-1 (super) # interface Serial 1.1 point-to-point
X330WAN-2USP-1 (super-subif:Serial1.1) # ip address 2.2.2.1 24
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay interface-dlci 16
```

```
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay class-dlci 16  
voip (6)
```

```
X330WAN-2USP-1 (super-subif:Serial1.1) # exit
```

```
X330WAN-2USP-1 (super) # ip default-gateway serial 1.1
```

* Description of footnoted commands (also applies to identical stages in configuring Site B):

- (1) The CIR Out value depends on the number of phones (approx. 26Kbps per phone for G.729 CODEC).
- (2) This is a value that causes the EIR to reach the Access Rate (192Kbps), where $EIR=(Bc+Be)/Tc$, in this configuration $EIR = (16000+8000)/0.125 = 192Kbps$.
- (3) This value is usually 1/8 of the CIR value, in this configuration $Tc = 125msec$.
- (4) In this configuration the non-high priority data packets are marked as DE when the transfer rate reaches 80% of the CIR.
- (5) At this stage, you configure X330WAN to fragment the data packets to prevent the long packets from causing delay to the voice packets.
- (6) At this stage you assign map-class VoIP to the interface DLCI.

Configuration Example 1 for Site B - Single VC Between Sites

Following is the configuration procedure for the X330WAN-2USP, as shown in Figure 4.11:

- Loopback and PMI interfaces configuration:

```
X330WAN-2USP-1 (super) # interface Loopback 1
```

```
X330WAN-2USP-1 (super-if:Loopback1) # ip address 20.20.20.20 24
```

The Primary management interface has changed. Please copy the running configuration to the start-up configuration file, and reset the device.

```
X330WAN-2USP-1 (super-if:Loopback1) # exit
```

```
X330WAN-2USP-1 (super) # copy running-config startup-config
```

```
X330WAN-2USP-1 (super) # reset
```

- FabricFastEthernet interface configuration:

```
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:1
```

```
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1) # ip address 3.3.3.1  
24
```

```
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1) # exit
```

```
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:1.1
```

```
X330WAN-2USP-1 (super-subif:FabricFastEthernet1:1.1) # ip address  
4.4.4.1 24
```

```
X330WAN-2USP-1 (super-if:FabricFastEthernet1:1.1) # exit
```

```
X330WAN-2USP-1 (super) # interface FabricFastEthernet 1:2
```

```
X330WAN-2USP-1 (super-if:FabricFastEthernet1:2) # ip address  
33.33.33.1 24
```



```
X330WAN-2USP-1(super-if:FabricFastEthernet1:2)# exit
```

- Configuration of a Policy list with the appropriate DSCP-CoS mappings:

```
X330WAN-2USP-1(super)# set qos policy-source local
X330WAN-2USP-1(super)# ip access-list-name 100 voice
X330WAN-2USP-1(super)# ip access-list-dscp operation 100 34 fwd7
X330WAN-2USP-1(super)# ip access-list-dscp operation 100 46 fwd6
X330WAN-2USP-1(super)# ip access-list-dscp trust 100 trust-cos-dscp
```
- Activating the Policy List on the FabricFastEthernet interface:

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1
X330WAN-2USP-1(super-if:FabricFastEthernet1)# ip access-group 100 in
X330WAN-2USP-1(super-if:FabricFastEthernet1)# exit
```
- Map-class configuration:

```
X330WAN-2USP-1(super)# map-class frame-relay voip
X330WAN-2USP-1(super-map-class)# cir out 128000
X330WAN-2USP-1(super-map-class)# be out 8000
X330WAN-2USP-1(super-map-class)# bc out 16000
X330WAN-2USP-1(super-map-class)# de pre-mark 80
X330WAN-2USP-1(super-map-class)# fragment
X330WAN-2USP-1(super-map-class)# exit
```
- Serial interface configuration:

```
X330WAN-2USP-1(super)# interface Serial 1
X330WAN-2USP-1(super-if:Serial1)# encapsulation frame-relay
X330WAN-2USP-1(super-if:Serial1)# bandwidth 192
X330WAN-2USP-1(super-if:Serial1)# frame-relay traffic-shaping
X330WAN-2USP-1(super-if:Serial1)# voip-queue
X330WAN-2USP-1(super-if:Serial1)# exit
```
- Frame relay sub interface configuration:

```
X330WAN-2USP-1(super)# interface Serial 1.1 point-to-point
X330WAN-2USP-1(super-subif:Serial1.1)# ip address 2.2.2.2 24
X330WAN-2USP-1(super-subif:Serial1.1)# frame-relay interface-dlci 16
X330WAN-2USP-1(super-subif:Serial1.1)# frame-relay class-dlci 16
voip
X330WAN-2USP-1(super-subif:Serial1.1)# exit
X330WAN-2USP-1(super)# ip default-gateway serial 1.1
```

Scenario 2 - Priority DLCI and Traffic Shaping

In Figure 4.11, Site A contains four IP phones and a data LAN connected via a P333T-PWR switch to a G700 Media Gateway. The G700 Media Gateway houses an X330W-2USP expansion module that is connected to a Frame Relay network via a 192Kbps Frame Relay encapsulated V.35 interface. Following are the connection details for Site A:

- Two VCs:
 - One with CIR = 128Kbps, DLCI = 16
 - The second with CIR = 0, DLCI = 17
- The IP phones are configured with the following DSCP tagging:
 - Voice = DSCP 46
 - Voice control = DSCP 34
- Network IPs (all 24 mask):
 - IP phones - 1.1.1.0 (VLAN 1)
 - Data - 11.11.11.0 (VLAN 2)
 - Serial - 2.2.2.1
 - Gatekeeper - 149.49.54.81
 - MGP - 149.49.54.82
 - VoIP (MGP) - 149.49.54.83

Site B contains four IP phones and a data LAN connected to a P333T-PWR switch in a stack with a G700 Media Gateway. The G700 Media Gateway houses an X330W-2USP expansion module that is connected to a Frame Relay network via a 192Kbps Frame Relay encapsulated V.35 interface. Following are the connection details for Site B:

- Two VCs:
 - One with CIR = 128Kbps, DLCI = 16
 - The second with CIR = 0, DLCI = 17
- The IP phones are configured with DSCP tagging:
 - Voice = DSCP 46
 - Voice control = DSCP 34
- Network IPs (all 24 mask):
 - IP phones - 3.3.3.0 (VLAN 1)
 - Data - 33.33.33.0 (VLAN 2)
 - Serial - 2.2.2.2
 - MGP - 4.4.4.10
 - VoIP (MGP) - 4.4.4.11

Configuration Example 2 for Site A - Two VCs Between Sites

Following is the configuration procedure for the X330WAN-2USP, as shown in Figure 4.11. Commands with footnotes are described at the end of the configuration procedure.

- Loopback and PMI interfaces configuration:

```
X330WAN-2USP-1(super)# interface Loopback 1
```

```
X330WAN-2USP-1(super-if:Loopback1)# ip address 10.10.10.10 24
```

The Primary management interface has changed. Please copy the running configuration to the start-up configuration file, and reset the device.

```
X330WAN-2USP-1(super-if:Loopback1)# exit
```

```
X330WAN-2USP-1(super)# copy running-config startup-config
```

```
X330WAN-2USP-1(super)# reset
```

- FabricFastEthernet interface configuration:

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1:1
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:1)# ip address 1.1.1.1 24
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:1)# exit
```

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1:1.1
```

```
X330WAN-2USP-1(super-subif:FabricFastEthernet1:1.1)# ip address 149.49.54.80 24
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:1.1)# exit
```

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1:2
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:2)# ip address 11.11.11.1 24
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:2)# exit
```

- Configuration of a Policy list with the appropriate DSCP-CoS mappings:

```
X330WAN-2USP-1(super)# set qos policy-source local
```

```
X330WAN-2USP-1(super)# ip access-list-name 100 voice
```

```
X330WAN-2USP-1(super)# ip access-list-dscp operation 100 34 fwd7
```

```
X330WAN-2USP-1(super)# ip access-list-dscp operation 100 46 fwd6
```

```
X330WAN-2USP-1(super)# ip access-list-dscp trust 100 trust-cos-dscp
```

- Activating the Policy List on the FabricFastEthernet interface:

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1)# ip access-group 100 in
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1)# exit
```

- Map-class configuration:

```
X330WAN-2USP-1(super)# map-class frame-relay voip
```

```
X330WAN-2USP-1(super-map-class)# cir out 128000 (1)
```

```
X330WAN-2USP-1(super-map-class)# bc out 16000 (2)
```

```
X330WAN-2USP-1(super-map-class)# exit
```

```

X330WAN-2USP-1 (super) # map-class frame-relay data
X330WAN-2USP-1 (super-map-class) # cir out 0 (3)
X330WAN-2USP-1 (super-map-class) # be out 192000 (4)
X330WAN-2USP-1 (super-map-class) # fragment (5)
X330WAN-2USP-1 (super-map-class) # exit
• Serial interface configuration:
X330WAN-2USP-1 (super) # interface Serial 1
X330WAN-2USP-1 (super-if:Serial1) # encapsulation frame-relay
X330WAN-2USP-1 (super-if:Serial1) # bandwidth 192
X330WAN-2USP-1 (super-if:Serial1) # frame-relay traffic-shaping
X330WAN-2USP-1 (super-if:Serial1) # voip-queue
X330WAN-2USP-1 (super-if:Serial1) # exit
• Frame relay sub interface configuration:
X330WAN-2USP-1 (super) # interface Serial 1.1 point-to-point
X330WAN-2USP-1 (super-subif:Serial1.1) # ip address 2.2.2.1 24
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay interface-dlci 16
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay priority-dlci-
group 16 17 (6)
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay class-dlci 16
voip (7)
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay class-dlci 17
data (8)
X330WAN-2USP-1 (super-subif:Serial1.1) # exit
• Default gateway configuration:
X330WAN-2USP-1 (super) # ip default-gateway serial 1.1

```

* Description of footnoted commands (also applies to identical stages in configuring Site B):

- (1) This value depends on the number of phones used (approx. 26Kbps per phone).
- (2) This value is usually 1/8 of the CIR, in this configuration example Tc = 125msec.
- (3) At this stage you configure no CIR for data traffic.
- (4) At this stage, since CIR = 0 all of the bandwidth for data traffic is EIR.
- (5) At this stage you configure to fragment data packets to prevent long data packets from delaying voice packets.
- (6) At this stage you assign DLCI 16 to high priority traffic, and DLCI 17 to all remaining traffic.
- (7) At this stage you assign map-class "VoIP" to DLCI 16, high priority.
- (8) At this stage you assign map-class "data" to DLCI 17.

Configuration Example 2 for Site B - Two VCs Between Sites

Following is the configuration procedure for the X330WAN-2USP as shown in Figure 4.11:

- Loopback and PMI interfaces configuration:

```
X330WAN-2USP-1(super)# interface Loopback 1
```

```
X330WAN-2USP-1(super-if:Loopback1)# ip address 20.20.20.20 24
```

The Primary management interface has changed. Please copy the running configuration to the start-up configuration file, and reset the device.

```
X330WAN-2USP-1(super-if:Loopback1)# exit
```

```
X330WAN-2USP-1(super)# copy running-config startup-config
```

```
X330WAN-2USP-1(super)# reset
```

- FabricFastEthernet interface configuration:

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1:1
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:1)# ip address 3.3.3.1 24
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:1)# exit
```

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1:1.1
```

```
X330WAN-2USP-1(super-subif:FabricFastEthernet1:1.1)# ip address 4.4.4.1 24
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:1.1)# exit
```

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1:2
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:2)# ip address 33.33.33.1 24
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:2)# exit
```

- Configuration of a Policy list with the appropriate DSCP-CoS mappings:

```
X330WAN-2USP-1(super)# set qos policy-source local
```

```
X330WAN-2USP-1(super)# ip access-list-name 100 voice
```

```
X330WAN-2USP-1(super)# ip access-list-dscp operation 100 34 fwd7
```

```
X330WAN-2USP-1(super)# ip access-list-dscp operation 100 46 fwd6
```

```
X330WAN-2USP-1(super)# ip access-list-dscp trust 100 trust-cos-dscp
```

- Activating the Policy List on the FabricFastEthernet interface:

```
X330WAN-2USP-1(super)# interface FabricFastEthernet 1
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1)# ip access-group 100 in
```

```
X330WAN-2USP-1(super-if:FabricFastEthernet1)# exit
```

- Map-class configuration:

```
X330WAN-2USP-1(super)# map-class frame-relay voip
```

```
X330WAN-2USP-1(super-map-class)# cir out 128000
```

```
X330WAN-2USP-1(super-map-class)# bc out 16000
```

```
X330WAN-2USP-1(super-map-class)# exit
```

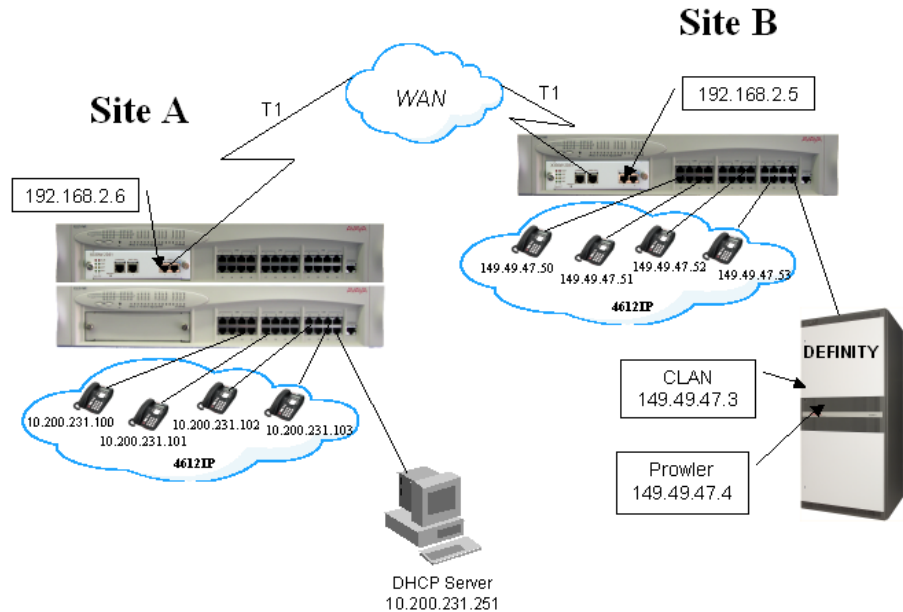
```
X330WAN-2USP-1(super)# map-class frame-relay data
```

```
X330WAN-2USP-1 (super-map-class) # cir out 0
X330WAN-2USP-1 (super-map-class) # be out 192000
X330WAN-2USP-1 (super-map-class) # fragment
X330WAN-2USP-1 (super-map-class) # exit
• Serial interface configuration:
X330WAN-2USP-1 (super) # interface Serial 1
X330WAN-2USP-1 (super-if:Serial1) # encapsulation frame-relay
X330WAN-2USP-1 (super-if:Serial1) # bandwidth 192
X330WAN-2USP-1 (super-if:Serial1) # frame-relay traffic-shaping
X330WAN-2USP-1 (super-if:Serial1) # voip-queue
X330WAN-2USP-1 (super-if:Serial1) # exit
• Frame relay sub interface configuration:
X330WAN-2USP-1 (super) # interface Serial 1.1 point-to-point
X330WAN-2USP-1 (super-subif:Serial1.1) # ip address 2.2.2.2 24
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay interface-dlci 16
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay priority-dlci-
group 16 17
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay class-dlci 16
voip
X330WAN-2USP-1 (super-subif:Serial1.1) # frame-relay class-dlci 17
data
X330WAN-2USP-1 (super-subif:Serial1.1) # exit
• Default gateway configuration:
X330WAN-2USP-1 (super) # ip default-gateway serial 1.1
```

VoIP Implementation with DEFINITY (CLAN and Prowler)

Figure 4.12 illustrates a PPP VoIP configuration with DEFINITY between two sites connected over a WAN.

Figure 4.12 PPP VoIP Configuration with DEFINITY



In Figure 4.12, Site A contains IP phones connected to a P333T-PWR switch. The P333T-PWR switch houses a X330W-2DS1 expansion module that is connected to the WAN via a 24 timeslot (1.536 Mbps) T1 interface. Following are the connection details for Site A:

- The IP phones are configured with the following DSCP tagging:
 - Voice = DSCP 46
 - Voice control = DSCP 34



Note: The Policy list in the next configuration is based on the assumption that the Media Gateway, Media Server, and the IP phones send VoIP control packets with a DSCP value of 34 and voice with a DSCP value of 46. If any of the components of the topology are sending control or voice packets with other DSCP values, you must make changes in the Policy list.

- The CLAN in the DEFINITY has a default RTP UDP port range is 2048 to 3028.

- Network IPs:
 - IP phones - 10.200.231.0 24 (VLAN 1)
 - Serial - 192.168.2.6 30
 - DHCP Server - 10.200.231.251

Site B contains IP phones connected to a P333T-PWR switch. The P333T-PWR switch houses a X330W-2DS1 expansion module that is connected to the WAN via a 24 timeslot (1.536 Mbps) T1 interface. A DEFINITY Gateway is connected to the P333T-PWR via the LAN. Following are the connection details for Site B:

- IP phone are configured with DSCP tagging:
 - Voice = DSCP 46
 - Voice control = DSCP 34
- The CLAN in the DEFINITY has a default RTP UDP port range is 2048 to 3028.
- Network IPs:
 - IP phones - 149.49.47.0 24 (VLAN 1)
 - Serial - 192.168.2.5 30
 - CLAN - 149.49.47.3
 - Prowler - 149.49.47.4

Configuration Example for Site A

The following is the configuration procedure for the X330WAN-2DS1, as shown in Figure 4.12. Commands with footnotes are described at the end of the configuration procedure.

- Loopback and PMI interfaces configuration:

```
X330WAN-2DS1-1 (super) # interface Loopback 1
```

```
X330WAN-2DS1-1 (super-if:Loopback1) # ip address 10.10.10.10 24
```

The Primary management interface has changed. Please copy the running configuration to the start-up configuration file, and reset the device.

```
X330WAN-2DS1-1 (super-if:Loopback1) # exit
```

```
X330WAN-2DS1-1 (super) # copy running-config startup-config
```

```
X330WAN-2DS1-1 (super) # reset
```

- FabricFastEthernet interface configuration:

```
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1:1
```

```
X330WAN-2DS1-1 (super-subif:FabricFastEthernet1:1.1) # ip address 10.200.231.250 24
```

```
X330WAN-2DS1-1 (super-if:FabricFastEthernet1:1.1) # exit
```

- Configuration of a Policy list with the appropriate DSCP-CoS mappings:

```
X330WAN-2DS1-1 (super) # set qos policy-source local
```

```
X330WAN-2DS1-1 (super) # ip access-list-name 100 voice
```

```
X330WAN-2DS1-1 (super) # ip access-list-dscp operation 100 34 fwd7 (1)
```

```
X330WAN-2DS1-1 (super) # ip access-list-dscp operation 100 46 fwd6 (2)
```



```
X330WAN-2DS1-1 (super) # ip access-list-dscp trust 100 trust-cos-dscp(3)
• Activating the Policy List on the FabricFastEthernet interface:
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1
X330WAN-2DS1-1 (super-if: FabricFastEthernet1) # ip access-group 100 in
X330WAN-2DS1-1 (super-if: FabricFastEthernet1) # exit
• Serial interface configuration:
X330WAN-2DS1-1 (super) # controller t1 1
X330WAN-2DS1-1 (super-controller:1) # linecode b8zs
X330WAN-2DS1-1 (super-controller:1) # framing esf
X330WAN-2DS1-1 (super-controller:1) # channel-group 1 timeslots 1-24
speed 64
X330WAN-2DS1-1 (super-controller:1) # exit
X330WAN-2DS1-1 (super) # interface Serial 1:1
X330WAN-2DS1-1 (super-if: Serial1:1) # ip address 192.168.2.6 30
X330WAN-2DS1-1 (super-if: Serial1:1) # mtu 300
```



Note: Some LAN data applications do not support fragmented packets. In this case, do not change the MTU from its default of 1500.

- VoIP configuration:

```
X330WAN-2DS1-1 (super-if: Serial1:1) # voip-queue
X330WAN-2DS1-1 (super-if: Serial1:1) # ip rtp header-compression
X330WAN-2DS1-1 (super-if: Serial1:1) # ip rtp port-range 2048 3028 (4)
X330WAN-2DS1-1 (super-if: Serial1:1) # queue-limit 1 144 (5)
X330WAN-2DS1-1 (super-if: Serial1:1) # exit
```

- Static routes configuration:

```
X330WAN-2DS1-1 (super) # ip default-gateway Serial 1:1
```

- DHCP configuration:

```
X330WAN-2DS1-1 (super) # ip bootp-dhcp relay
```

* Description of footnoted commands (also applies to identical stages in configuring Site B):

(1) At this stage you apply Priority 7 to Voice Control traffic.

(2) At this stage you apply Priority 6 to RTP traffic.

(3) At this stage you apply maximum trust between 802.1p priority and DSCP.

(4) At this stage you are matching the RTP port range used for RTP compression, to that of the CLAN.

(5) At this stage the default queue size is 60, and since cRTP is enabled you can increase the VoIP queue size.

Configuration Example for Site B

The following is the configuration procedure for the X330WAN-2DS1, as shown in Figure 4.12:

- Loopback and PMI interfaces configuration:

```
X330WAN-2DS1-1 (super) # interface Loopback 1
X330WAN-2DS1-1 (super-if:Loopback1) # ip address 20.20.20.20 32
```

The Primary management interface has changed. Please copy the running configuration to the start-up configuration file, and reset the device.

```
X330WAN-2DS1-1 (super-if:Loopback1) # exit
X330WAN-2DS1-1 (super) # copy running-config startup-config
X330WAN-2DS1-1 (super) # reset
```

- - FabricFastEthernet interface configuration:

```
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1:1
X330WAN-2DS1-1 (super-if:FabricFastEthernet1:1) # ip address
149.49.47.1 24
X330WAN-2DS1-1 (super-if:FabricFastEthernet1:1) # ip bootp-dhcp server
10.200.231.251
X330WAN-2DS1-1 (super-if:FabricFastEthernet1:1) # exit
```

- Configuration of a Policy list with the appropriate DSCP-CoS mappings:

```
X330WAN-2DS1-1 (super) # set qos policy-source local
X330WAN-2DS1-1 (super) # ip access-list-name 100 voice
X330WAN-2DS1-1 (super) # ip access-list-dscp operation 100 34 fwd7
X330WAN-2DS1-1 (super) # ip access-list-dscp operation 100 46 fwd6
X330WAN-2DS1-1 (super) # ip access-list-dscp trust 100 trust-cos-dscp
```

- Activating the Policy List on the FabricFastEthernet interface:

```
X330WAN-2DS1-1 (super) # interface FabricFastEthernet 1
X330WAN-2DS1-1 (super-if:FabricFastEthernet1) # ip access-group 100 in
X330WAN-2DS1-1 (super-if:FabricFastEthernet1) # exit
```

- Serial interface configuration:

```
X330WAN-2DS1-1 (super) # controller t1 1
X330WAN-2DS1-1 (super-controller:1) # linecode b8zs
X330WAN-2DS1-1 (super-controller:1) # framing esf
X330WAN-2DS1-1 (super-controller:1) # channel-group 1 timeslots 1-24
speed 64
X330WAN-2DS1-1 (super-controller:1) # exit
X330WAN-2DS1-1 (super) # interface Serial 1:1
X330WAN-2DS1-1 (super-if:Serial1:1) # ip address 192.168.2.5 30
```

```
X330WAN-2DS1-1(super-if:Serial1:1)# mtu 300
```



Note: Some LAN data applications do not support fragmented packets. In this case, do not change the MTU from its default of 1500.

- VoIP configuration:

```
X330WAN-2DS1-1(super-if:Serial1:1)# voip-queue
```

```
X330WAN-2DS1-1(super-if:Serial1:1)# ip rtp header-compression
```

```
X330WAN-2DS1-1(super-if:Serial1:1)# ip rtp port-range 2048 3028
```

```
X330WAN-2DS1-1(super-if:Serial1:1)# queue-limit 1 144
```

```
X330WAN-2DS1-1(super-if:Serial1:1)# exit
```

- Static routes configuration:

```
X330WAN-2DS1-1(super)# ip route 10.200.231.0 24 serial 1:1
```

- DHCP configuration:

```
X330WAN-2DS1-1(super)# ip bootp-dhcp relay
```


Troubleshooting

This chapter explains how to troubleshoot operational difficulties with the X330WAN, and includes the following sections:

- **Monitoring Traffic** - An explanation of the output from the CLI command used for monitoring the E1/T1 port's status.
- **Handling E1/T1 Alarms** - A list of alarms including alarm indicators, explanations, and methods for handling alarm situations.
- **Using Loopbacks** - Instructions for using loopback tests to determine the cause of an alarm condition.

Troubleshooting the X330WAN should be performed according to layers. When a problem appears, begin isolating it by troubleshooting Layer 1 - the controller's alarms and errors, then proceed to Layer 2, and finally Layer 3.

Monitoring Traffic

You can monitor the state of the X330W-2DS1's E1/T1 ports by entering the **show controllers** command. The resulting output provides information about the state of the E1/T1 controller and reports alarms. In addition, the output provides statistics on the state of the controller over the last 24 hour period. To receive output for a specific port, enter the port number after the **show controllers** command.

Following is an output example for the **show controllers** command for an E1 port:

```
E1 1 is up.
  No alarms detected.
  Framing is CRC4, Line Code is HDB3, Clock Source is
  Line.
  channel-group 1 timeslots 1-31
  Data in current interval (778 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0
    Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err
    Secs, 0 Unavail Secs
  Total Data (last 92 15 minute intervals):
    19958 Line Code Violations, 38 Path Code Violations
    0 Slip Secs, 5 Fr Loss Secs, 6 Line Err Secs, 0
```

```
Degraded Mins
 6 Errored Secs, 1 Bursty Err Secs, 5 Severely Err
Secs, 0 Unavail Secs
```

E1 2 is administratively down.

For information on the fields in the **show controllers** command output, refer to Chapter 6: *X330WAN CLI Commands*.

To monitor the state of the X330W-2USP ports, use the **show interface** command. For the output from the **show interface** command, see Chapter 6: *X330WAN CLI Commands*.

Handling E1/T1 Alarms

Alarms are reported by the LEDs on the X330W-2DS1 and via the CLI. When an alarm condition is detected by X330W-2DS1, it sends a signal to all E1/T1 devices connected to it. Alarms can be categorized as one of the following:

- **Local Alarm Indication** - Generated by the X330W-2DS1 as a result of a line status problem sensed by the X330W-2DS1.
- **Remote Alarm Request** - Received by the X330W-2DS1 from the remote module.

The following table provides a list of alarms, the type of alarm, and the alarm condition on the module from which the alarm originates.

Table 5.1 Alarms

Alarm (E1/T1)	Alarm Type	Originating Alarm
LOS/LOS	Local Alarm Indicator	N/A
LOF/Red	Local Alarm Indicator	N/A
High BER/Major	Local Alarm Indicator	N/A
Low BER/Minor	Local Alarm Indicator	N/A
RAI/Yellow	Remote Alarm Request	LOS, LOF, BER, AIS
AIS/Blue	Remote Alarm Request	Maintenance request

More detailed information about alarms can be obtained using the **show controllers** CLI command. For more information, refer to "Monitoring Traffic" on page 79.

The following sections discuss the different types of alarms, how each alarm type is indicated, and possible corrective actions to end the alarm.

In addition to the alarms, X330W-2DS1 provides error messages when it can not establish a connection with the host P330 switch. In this case, verify that the appropriate software versions are installed in the host P330 switch.

LOS

Definition: Loss of Signal. This alarm is the result of a loss of the clock synchronization signal. The alarm severity is Major.

Indication: The alarm is indicated when the SIG LED is off and the ALM LED lights.

Corrective Actions:

- Check that the E1/T1 cable is properly connected to the E1/T1 ports at both ends of the connection.
- Check the integrity of the cable and pinouts.
- Ensure that the receiving and transmitting pairs are not reversed.
- If regenerators are used, check the integrity of the regenerators.

LOF/Red

Definition: Loss of Frame. This alarm is the result of a loss of the frame synchronization signal. The alarm severity is Major.

Indication: The alarm is indicated when the ALM LED lights and the ACT LED is off.

Corrective Actions:

Ensure that the line settings are compatible on both sides of the line.

For example:

- Ensure that both sides of the connection are configured to use the same line code and framing configuration. Use the **show controllers** command to view the current line code. Use the **framing** command to configure the framing mode and the **line code** command to configure the line code.
- For T1 lines, ensure that the line is configured for the cable length in use. Use the **show controllers** command to view the current configuration. Use the **cablelength long** and **cablelength short** commands to change the cable length configuration.

For detailed information on CLI commands, see Chapter 6: *X330WAN CLI Commands*.



Note: After clearing the condition causing the LOF alarm, the module continues to indicate an LOF condition for approximately 10 seconds.

High BER/Major

Definition: High threshold Bit Error Rating (BER). This alarm is the result of an average error rate of 1 bit per 1000 for 10 seconds. The alarm severity is Major.

Indication: The alarm is indicated using the **show controllers** command from the CLI. For more information, refer to "Monitoring Traffic" on page 79.

Corrective Actions:

- Check the physical integrity of the E1/T1 line.
- If regenerators are used, check the integrity of the regenerators.
- Use loopbacks to help pinpoint the cause of the alarm condition. For information on using loopbacks, refer to "Using Loopbacks" on page 83.



Note: After clearing the condition causing the High BER/Major alarm, the module continues to indicate a High BER/Major condition for approximately 11 seconds.

RAI/Yellow

Definition: Remote Alarm Indication, caused by the remote Rx line being down. The alarm severity is Major.

Indication: The alarm is indicated when the ALM LED lights or by using the **show controllers** command from the CLI. For more information, refer to "Monitoring Traffic" on page 79.

Corrective Action:

- Check your configuration (for example, framing) to verify that it matches the configuration of the remote end.

AIS/Blue

Definition: Alarm Indication Signal. The remote module is not sending data, probably due to an interface shutdown or a rebooting module. The alarm severity is Major.

Indication: The alarm is indicated when the ALM LED lights or by using the **show controllers** command from the CLI. For more information, refer to "Monitoring Traffic" on page 79.

Corrective Actions:

- Call the administrator of the remote module.
- Wait for the signal to return.

Troubleshooting X330W-2USP

You can obtain statistical information regarding module performance, error rates, and DTE/DCE signal statuses using the **show interfaces** command. X330W-2USP does not indicate a failure via alarm LEDs.

X330W-2USP provides error messages in the following situations:

- **Cable connection fault** - When there is a fault with the cable connections or when a DCE cable is connected. Check the cables and connections.
- **Host communication fault** - When the X330WAN can not establish a connection with the host P330 switch. In this case, verify that the appropriate software versions are installed in the host P330 switch.

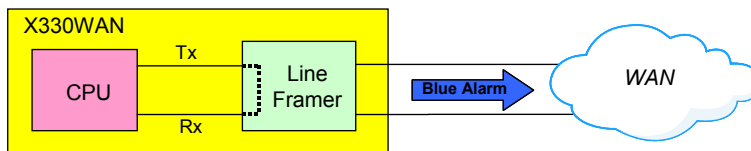
If X330WAN (or the connected DCE) reports data errors (CRC, etc.), there might exist a phase shift between the data and the accompanying clock. In this case use the **invert txclock** command to invert the transmit clock signal (TxC) from the DCE.

Using Loopbacks

The X330W-2DS1 module supports the following loopback types:

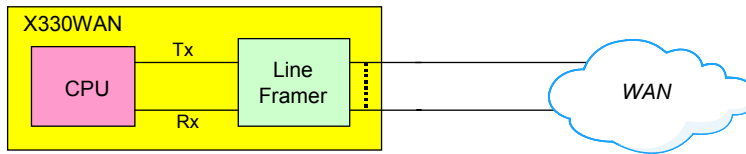
- **Diag Loopback (E1/T1)** - The X330W-2DS1 CPU instructs the Line Framer to create a loop towards the CPU. A Blue Alarm (AIS) is sent on the line to the peer module. The Diag Loopback is illustrated in Figure 5.1.

Figure 5.1 Diag Loopback



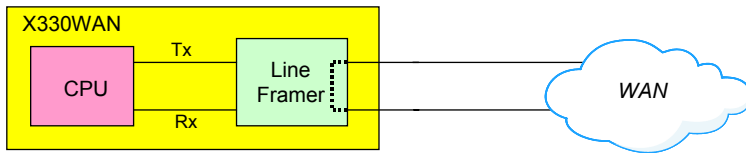
- **Local Line Loopback (E1/T1)** - The X330W-2DS1 Line Framer creates a loop on the line towards the peer module. The Local Line Loopback is illustrated in Figure 5.2.

Figure 5.2 Local Line Loopback



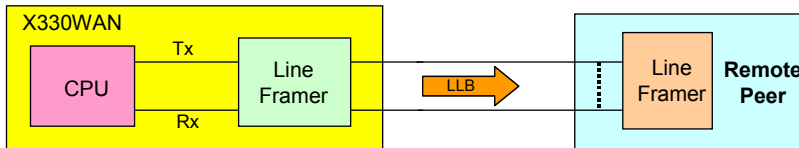
- **Local Payload Loopback (E1/T1)** - The X330W-2DS1 Line Framer creates a loop through itself and re-frames the signal on its way back from the peer module. The Local Payload Loopback is illustrated in Figure 5.3.

Figure 5.3 Local Payload Loopback



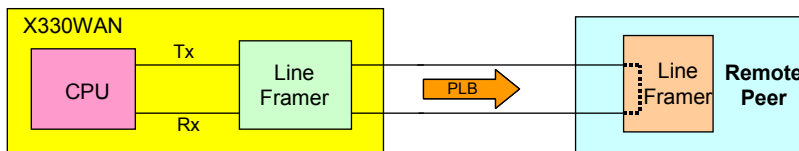
- **Remote Line Loopback (T1 only)** - X330W-2DS1 sends the remote peer module a request to create a line loop. A Line Loopback signal is used to indicate the request. The Remote Line Loopback is illustrated in Figure 5.4.

Figure 5.4 Remote Line Loopback



- **Remote Payload Loopback (T1 only)** - X330W-2DS1 sends the remote peer module a request to create a loop through its Line Framer. A Payload Loopback signal is used to indicate the request. The Remote Payload Loopback type is only available in ESF framing. The Remote Payload Loopback is illustrated in Figure 5.5.

Figure 5.5 Remote Payload Loopback



Use the `loopback diag`, `loopback local`, or `loopback remote` command to instruct X330W-2DS1 to perform a loopback. For more information about these commands, see Chapter 6: *X330WAN CLI Commands*.

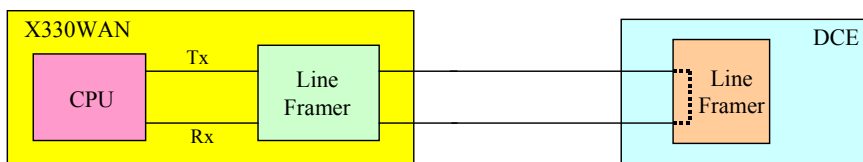


Note: If the loopback troubleshooting procedure involves using PPP sessions (for example, using ICMP over PPP), disable the PPP “Keep Alive” option using the **no keepalive** command. This is necessary since the PPP keep alive shuts down the PPP session if it discovers a loop after about 50 seconds.

The X330W-2USP supports the following loopback type:

- **USP Loopback** - X330W-2USP (V.35 and EIA530A protocols only) sends the remote peer module a request to create a loop through its Line Framer. A loopback signal is used to indicate the request. The USP Loopback is illustrated in Figure 5.6.

Figure 5.6 USP Loopback



Use the **loopback** command from the Serial interface context to instruct X330W-2USP to perform a loopback. For more information about this command, see Chapter 6: *X330WAN CLI Commands*.

X330WAN CLI Commands

This chapter provides a complete list of all X330WAN module-related CLI commands. Each command that appears on the list is accompanied by a detailed description, including the proper syntax. The list is presented in alphabetical order to help you locate commands easily.

Introduction: About the CLI

The CLI is command-line driven and does not have any menus. To activate a configuration option, type the desired command at the prompt and press Enter. To configure the X330WAN, you must either be in supervisor mode, or enter the **configure** context. Generic commands are performed from the **configure** context. If you are in supervisor mode or have entered the **configure** context, you can enter any of the following contexts:

- Controller (X330W-2DS1 only)
- Interface Console
- Interface Fast Ethernet
- Interface FabricFastEthernet
- Interface Serial
- Interface Loopback
- Other contexts

Layer 1 (E1/T1) commands are performed from the **controller** context, and Layer 2/Layer 3 (Fabric, PPP, Frame Relay, Fast Ethernet, IP) commands are performed from the various Interface contexts.

To exit a context, type **exit**.

You can use all **show** commands in user mode.

For a list of all Controller commands, see "Controller CLI Commands (X330WAN-2DS1 Only)" on page 115.

For a list of all Interface Fast Ethernet commands, see "Fast Ethernet Interface CLI Commands" on page 112.

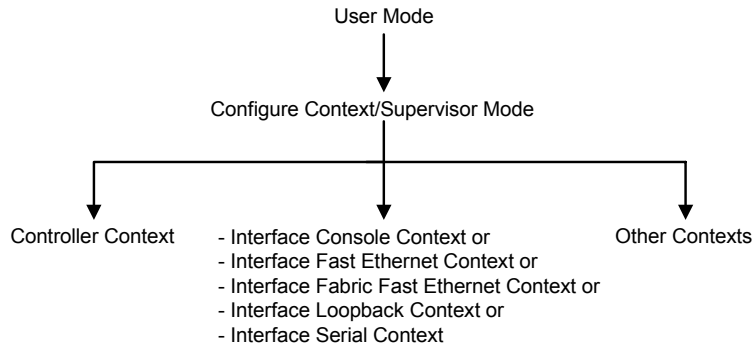
For a list of all Interface FabricFastEthernet commands, see "FabricFast Ethernet Interface CLI Commands" on page 114.

For a list of all Interface Loopback commands, see "Loopback CLI Commands" on page 153.

For a list of all Interface Serial commands, see "Interface Serial CLI Commands" on page 129.

Figure 6.1 illustrates the context hierarchy.

Figure 6.1 X330WAN CLI Contexts



For a list of the specific contexts for the X330W-2DS1, refer to Table 3.1 on page 24.
For a list of the specific contexts for the X330W-2USP, refer to Table 3.2 on page 27.

X330WAN CLI Prompts

The following table displays examples of X330WAN-2DS1 CLI prompts.

Table 6.1 X330WAN-2DS1 CLI Prompts

Mode/Context	X330W-2DS1 Prompt	X330W-2USP Prompt
User	X330WAN-2DS1-N>	X330WAN-2USP-N>
Supervisor	X330WAN-2DS1-N(super) #	X330WAN-2USP-N(super) #
Configure	X330WAN-2DS1-N(configure) #	X330WAN-2USP-N(configure) #
• Controller	X330WAN-2DS1-N(config-controller:n) #	X330WAN-2USP-N(config-controller:n) #
• Interface Console	X330WAN-2DS1-N(config-if:CON) #	X330WAN-2USP-N(config-if:CON) #
• Interface Fast Ethernet	X330WAN-2DS1-N(config-if:FastEthernet1) #	X330WAN-2USP-N(config-if:FastEthernet1) #
• Interface FabricFast Ethernet	X330WAN-2DS1-N(config-if:FabricFastEthernet1) #	X330WAN-2USP-N(config-if:FabricFastEthernet1) #
• Interface Loopback	X330WAN-2DS1-N(config-if:LoopbackZ) #	X330WAN-2USP-N(config-if:LoopbackZ) #

Table 6.1 X330WAN-2DS1 CLI Prompts (Continued)

• Interface Serial	X330WAN-2DS1-N(config-if:Serialn:x)#	X330WAN-2USP-N(config-if:Serialn)#
--------------------	--------------------------------------	------------------------------------

N is the number of the device in a stack of WAN devices, n is the number of the WAN port (1 or 2), z is the interface number, and x is the number of the channel group.

General: Device Commands

This section contains a list of all general device CLI commands.

banner login

Use the `banner login` command to enter the login banner configuration mode. The `no` form of this command sets the login banner to the default.



Note: Before creating a new banner, delete the current banner using the `no banner login` command.

Syntax

```
[no] banner login
```

Example

```
X330WAN-2USP-1 (super) # banner login
```

banner post-login

Use the `banner post-login` command to enter the post-login configuration mode. The `no` form of this command sets the post-login banner to the default.



Note: Before creating a new banner, delete the current banner using the `no banner post-login` command.

Syntax

```
[no] banner post-login
```

Example

```
X330WAN-2DS1-1 (super) # banner post-login
```

clear screen

Use the `clear screen` command to clear the current terminal display.

Syntax

```
clear screen
```

clear snmp trap

Use the `clear snmp trap` command to clear an entry from the SNMP trap receiver table.

Syntax

```
clear snmp trap {<rcvr_addr>|all}
```

Parameters

`rcvr_addr` IP address of the trap receiver (the SNMP management station) to clear.

`all` Keyword that specifies every entry in the SNMP trap receiver table.

Example

```
X330WAN-2DS1-1(super)# clear snmp trap 192.122.173.82  
SNMP trap receiver deleted.
```

clear timezone

Use the `clear timezone` command to restore the timezone to its default, Coordinated Universal Time (UTC).

Syntax

```
clear timezone
```

copy running-config startup-config

Use the `copy running-config startup-config` command to copy the device configuration from the current RAM Running Configuration to the NVRAM Startup Configuration.

Syntax

```
copy running-config startup-config
```


copy running-config tftp

Use the `copy running-config tftp` command to copy the device configuration from the current RAM Running Configuration to the TFTP file.

Syntax

```
copy running-config tftp <filename> <ip>
```

Parameters

filename	The file name (full path).
ip	The IP address of the host.

Example

```
X330WAN-2DS1-1(configure)# copy running-config tftp  
c:\p332\router1.cfg 192.168.49.10
```

copy startup-config tftp

Use the `copy startup-config tftp` command to copy the device configuration from the NVRAM Startup Configuration to the TFTP file.

Syntax

```
copy startup-config tftp <filename> <ip>
```

Parameters

filename	The file name (full path).
ip	The IP address of the host.

Example

```
X330WAN-2DS1-1(configure)# copy startup-config tftp  
c:\p332\router1.cfg 192.168.49.10
```

copy tftp startup-config

Use the `copy tftp startup-config` command to copy the device configuration from the saved TFTP file to the NVRAM Startup Configuration NVRAM.



Note: Before downloading the Startup Configuration file to a X330W-2DS1 module, verify that the current DS mode of the module (E1 or T1) is the same as the DS mode in the Startup Configuration file you are about to download. If necessary, change the X330W-2DS1's DS mode using the `ds-mode` command, prior to downloading.

Syntax

```
copy tftp startup-config <filename> <ip>
```

Parameters

filename	The file name (full path).
ip	The IP address of the host.

Example

```
X330WAN-2DS1-1 (configure)# copy tftp startup-config  
c:\p332\router1.cfg 192.168.49.10
```

copy tftp EW_archive

Use the `copy tftp EW_archive` command to download the WAN Device Manager application into the device via TFTP. To use this command, you must have an active TFTP server. If Avaya MultiService Network Manager is running, an additional TFTP server is not required.

Syntax

```
copy tftp EW_archive <filename> <ip>
```

Parameters

filename	Embedded Web Manager image file name (full path).
ip	The IP address of the TFTP server.

Example

```
X330WAN-2DS1-1 (configure)# copy tftp EW_archive c:\p330\p330web201  
192.168.49.10 5
```

copy tftp SW_image

Use the `copy tftp SW_image` command to update the software image and the device manager applications of a designated device. To use this command, you need to have an active TFTP server and create a file into which to download the data. If Avaya MultiService Network Manager is running, an additional tftp server is not required.

Syntax

```
copy tftp SW_image <sw-image-file> EW_archive <EmWeb_File>
<ip_address>
```

```
copy tftp SW_image <sw-image-file> EW_archive <ew_archive-file>
<ip_address>
```

Parameters

<code>sw-image-file</code>	Common name for the files that contain the Software Image and Embedded Web archive (full path).
<code>EmWeb_File</code>	Embedded Web Manager image file name (full path).
<code>ip_address</code>	The IP address of the TFTP server.
<code>ew_archive-file</code>	Embedded Web Manager archive file.

Example

```
X330WAN-2DS1-1(super)# copy tftp SW_image c:\p330\p330web101
EW_archive c:\p330\p330web201 192.168.49.10
```

dir

Use the `dir` command to show the file types that have been downloaded to the device.

Syntax

```
dir
```

Example

```
X330WAN-2DS1-1(super)# dir
```

M#	file	ver num	file type	file location	file description
1	startup-config	N/A	Startup Conf	Nv-Ram	Startup Config
1	running-config	N/A	Running Conf	Ram	Running Config

1	X330WAN-A	3.9.10	SW Component	Flash Bank A	Software Image - Bank A
1	X330WAN-B	3.12.10	SW RT Image	Flash Bank B	Software Image - Bank B
1	P3WAN	3.12.3	SW Web Image	Nv-Ram	EmWeb application
1	X330WAN-Booter	3.12.1	SW BootImage	Nv-Ram	Booter Image

Output Fields

Field	Description
M#	The device number.
file	There are several files loaded into the device's memory: <ul style="list-style-type: none"> • Startup-config - The file that contains the configuration used in the reboot process. • Running-config - The file that contains the configuration currently in use and the startup configuration. • X330WAN-A Image - Bank A - File that contains the previous firmware version download for redundancy. • X330WAN-B Image - Bank B - File that contains the firmware version download. • P3WAN - File that contains the Device Manager (Embedded Web) software. • X330WAN-Booter Image - File that contains the booter version.
ver num	S/W Version number - Relevant only for the Device Management software.
file type	There are several file types: <ul style="list-style-type: none"> • Startup-config - The configuration used in the reboot process. • Running Conf - The configuration currently in use and the startup configuration. • SW Component - The firmware version used when booting from bank A. • SW RT Image - The firmware version used as a default. • SW Web Image - Device Manager software archive file. • SW BootImage - The booter software image.
file location	Type of internal memory into which the file is loaded.
file description	Description of the file.



Note: If N/A is displayed for the EW_Archive file, the Device Manager software is not loaded correctly. Download the Device Manager software again.

ds-mode

Use the `ds-mode` command to set the controller's mode.



Note: After setting the controller's mode, this command:

1. Erases startup-config.
2. Resets the device.

Syntax

`ds-mode [e1|t1]`

Parameters

- `e1` Sets the device to E1 mode. All controllers are set to operate as E1.
- `t1` Sets the device to T1 mode. All controllers are set to operate as T1. This is the default.

Example

```
X330WAN-2DS1-1(configure)# ds-mode e1
Your startup-config file will be erased!
Your telnet session will be disconnected.
This operation may take a few minutes
The WAN module will reset, in order to make the required change.
Do you want to continue (Y/N)?
```



Note: If this command is entered when the correct mode is selected (for example, entering `ds1-mode e1` when the device is already in E1 mode), no errors are generated.



Caution: This action takes approximately 20 seconds. Do not enter any commands after confirming restart until after the restart process is complete.

erase startup-config

Use the `erase startup-config` command to erase the NVRAM startup configuration.

Syntax

erase startup-config

get time

Use the `get time` command to retrieve the time from the network.

Syntax

get time

Example

```
X330WAN-2DS1-1(super)# get time  
Time is being acquired from server 0.0.0.0!
```

hostname

Use the `hostname` command to change the Command Line Interface (CLI) prompt. The current device number always appears at the end of the prompt. Use the `no` form of this command to return the CLI prompt to its default.

Syntax

[no] hostname [<hostname_string>]

Parameters

`hostname_string` **none** – Displays current hostname.
 string – The string to be used as the hostname
 (up to 20 characters).

line (Banner login/post-login context)

Use the `line` command to add a line to the current banner message.

Syntax

```
line <number> [string]
```

Parameters

<code>number</code>	The line number to add the specified text.
<code>string</code>	The text to display on the specified line.



Note: To define a string that includes spaces, enclose the entire string in quotation marks (e.g., "New York").

Example

```
X330WAN-2DS1-1(super-banner-post-login)# line 3 "You have  
successfully logged off"
```

nvrAm initialize

Use the `nvrAm initialize` command to reset the WAN parameters to the factory defaults.

Syntax

```
nvrAm initialize
```

Example

```
X330WAN-2DS1-1(super)# nvrAm initialize  
This command will restore factory defaults, and can disconnect your  
telnet session  
*** Reset *** - do you want to continue (Y/N)?  
Connection closed by foreign host.  
host%
```

reset

Use the `reset` command to restart the system.

If you want to keep changes you made to the current running configuration, use the `copy running-config startup-config` command first.



Note: You should perform a reset after downloading software to the device.

Syntax

reset

Example

```
X330WAN-2DS1-1(super)# reset
```

This command will reset the module and may disconnect your telnet session.

```
*** Reset the device *** - do you want to continue (Y/N)? y
```

```
Connection closed by foreign host.
```

set boot bank

Use the `set boot bank` command to configure the software bank from which the device boots at the next boot process.

Syntax

set boot bank <value>

Parameters

value {bank-a | bank-b}

Example

```
X330WAN-2DS1-1(super)# set boot bank bank-a
```

```
Boot bank set to bank-a
```


set logout

Use the `set logout` command to set the number of minutes until the system automatically disconnects an idle session.

Syntax

```
set logout [timeout]
```

Parameters

`timeout` Number of minutes (0 to 999) until the system automatically disconnects an idle session. Setting the value to 0 disables the automatic disconnection of idle sessions (default is 15 minutes).

Example

To set the number of minutes until the system disconnects an idle session automatically:

```
X330WAN-2DS1-1(super)# set logout 20
```

Sessions will be automatically logged out after 20 minutes of idle time.

Example

To disable the automatic disconnection of idle sessions:

```
X330WAN-2DS1-1(super)# set logout 0
```

Sessions will not be automatically logged out.

set snmp trap

Use the `set snmp trap` commands to add an entry to the SNMP trap receiver table and to enable or disable the different SNMP traps for a specific receiver. First add the `rcvr_addr` and then enable/disable the different traps.

Syntax

```
set snmp trap <rcvr_addr>
```

```
set snmp trap <rcvr_addr> {enable|disable} {all|vlan_violation|...}
```

Parameters

`rcvr_addr` IP address of the system to receive SNMP traps.

`enable` Activate SNMP traps.

`disable` Deactivate SNMP traps.

`all` (Optional) Specify all trap types.

`vlan_violation` (Optional) Specify the VLAN violation trap from the TRAP-MIB.

Example

- To add an entry to the SNMP trap receiver table:

```
X330WAN-2DS1-1(super)# set snmp trap 192.168.173.42
SNMP trap receiver added.
```

- To enable SNMP `vlan_violation` traps to a specific manager:

```
X330WAN-2DS1-1(super)# set snmp trap 192.168.173.42 enable
vlan_violation
SNMP vlan_violation change traps enabled.
```

- To enable all traps to a specific manager:

```
X330WAN-2DS1-1(super)# set snmp trap 192.168.173.42 enable all
All SNMP traps enabled.
```

- To disable SNMP `vlan_violation` traps to a specific manager:

```
X330WAN-2DS1-1(super)# set snmp trap 192.168.173.42 disable
vlan_violation
SNMP vlan_violation traps disabled.
```

set snmp trap auth

Use the `set snmp trap auth` commands to enable/disable the sending of SNMP traps upon SNMP authentication failure.

Syntax

```
set snmp trap {enable|disable} auth
```

Example

```
X330WAN-2DS1-1(super)# set snmp trap enable auth
Authentication trap enabled
```

set snmp trap enable frame-relay

Use the `set snmp trap enable frame-relay` command to enable the DLCI link state SNMP traps. The traps are disabled by default.

Syntax

```
set snmp trap enable frame-relay
```

Example

```
X330WAN-2DS1-1(super)# set snmp trap enable frame-relay
```

set snmp trap disable frame-relay

Use the `set snmp trap disable frame-relay` command to disable the DLCI link stat SNMP traps. The traps are disabled by default.

Syntax

```
set snmp trap disable frame-relay
```

Example

```
X330WAN-2DS1-1(super)# set snmp trap disable frame-relay
```

set system contact

Use the `set system contact` command to set the system contact.

Syntax

```
set system contact [contact string]
```

Parameters

`contact string` Contact person. The contact person field is cleared if this field is left blank. A string of two words or more must be typed in quotation marks (e.g., "John Smith").

Example

```
X330WAN-2DS1-1(super)# set system contact "Gabby ext.545"
```

set system location

Use the `set system location` command to set the system location.

Syntax

```
set system location [location string]
```

Parameters

`location string` Location name. The location name is cleared if this field is left blank. A string of two words or more must be typed in quotation marks (e.g., "Operations Floor").

Example

```
X330WAN-2DS1-1(super)# set system location "Floor 5,Room 12"
```

set system name

Use the `set system name` command to set the system name.

Syntax

```
set system name [name string]
```

Parameters

`name string` System name. The system name is cleared if this field is left blank. A string of two words or more must be typed in quotation marks (e.g., "Backbone Stack").

Example

```
X330WAN-2DS1-1(super)# set system name "Banking System"
```

set time client

Use the `set time client` command to enable or disable the periodic network time acquisition by the device from the network time server (SNTP or TIME protocol).

Syntax

```
set time client {enable|disable}
```

set time protocol

Use the `set time protocol` command to set the protocol for use in the system as either SNTP protocol or TIME protocol.

Syntax

```
set time protocol [sntp-protocol|time-protocol]
```

Example

```
X330WAN-2DS1-1(super)# set time protocol sntp-protocol  
The protocol has been set to SNTP protocol
```

Example

```
X330WAN-2DS1-1(super)# set time protocol time-protocol  
The protocol has been set to TIME protocol
```

set time server

Use the `set time server` command to set the TIME server address.

Syntax

```
set time server <ip address>
```

Parameters

`ip address` IP address of the TIME server.

set timezone

Use the `set timezone` command to assign a timezone name and to set the time difference of your WAN relative to the Coordinated Universal Time (UTC/GMT). The minutes parameter can only be set to 30.

Syntax

```
set timezone <zone name> <hours|hours:min>
```

Parameters

`zone name` Three letter representation of the time zone.

Example

```
X330WAN-2DS1-1(super)# set timezone GMT -3:30
```

Timezone set to 'GMT', offset from UTC is -3:30 hours



Note: To define a name that includes spaces, enclose the entire name in quotation marks (e.g., "New York").

show banner login

Use the `show banner login` command to display the login banner.

Syntax

```
show banner login
```

Example

```
X330WAN-2USP-1(super)# show banner login
```

show banner post-login

Use the `show banner post-login` command to display the post-login banner.

Syntax

show banner post-login

Example

```
X330WAN-2USP-1 (super) # show banner post-login
```

show boot bank

Use the `show boot bank` command to display the software bank from which the device boots at the next boot process.

Syntax

show boot bank

Example

```
X330WAN-2DS1-1 (super) # show boot bank
Boot bank set to bank-a
```

show copy status

Use the `show copy status` command to show the status of the local configuration copy operation.

Syntax

show copy status

Example

```
X330WAN-2DS1-1 (super) # show copy status
Module #1
=====
Module           : 1
Source file      : startup-config
Destination file : running-config
Host             : -
Running state    : Idle
Failure display  : (null)
Last warning     : No warning
```

show dev log file

Use the `show dev log file` command to display the encrypted device's log file.

Syntax

```
show dev log file
```

show erase status

Use the `show erase status` command to view the status of the Erase Startup Configuration operation.

Syntax

```
show erase status
```

show image version

Use the `show image version` command to display the software version of the image on both memory banks of the device.

Syntax

```
show image version
```

Example

```
X330WAN-2DS1-1(super)# show image version
```

```
Bank   Version
```

```
----   -
```

```
A       3.9.7
```

```
B       3.12.10
```

```
Module number: 1
```

show logout

Use the `show logout` command to display the CLI logout.

Syntax

```
show logout
```

Example

```
X330WAN-2DS1-1(configure)# show logout
```

```
CLI timeout is 15 minutes
```

show module-identity

Use the `show module-identity` command to display the device identity required for acquiring a license.

Syntax

show module-identity

Example

```
show module-identity
```

```
X330WAN-2DS1-1(super)# show module-identity
Mod   Module Identity
---   -
1     1234567
```

show running-config

Use the `show running-config` command to show the RAM based configuration currently running on the device.

Syntax

show running-config

show snmp

Use the `show snmp` command to display SNMP information.

Syntax

show snmp

Example

```
X330WAN-2DS1-1(super)# show snmp
Authentication trap enabled

Community-Access      Community-String
-----
read-only              public
read-write            public
trap                  public

Trap-Rec-Address      Traps Enabled
-----
```


show startup-config

Use the `show startup-config` command to show the NVRAM based configuration loaded automatically at startup.

Syntax

```
show startup-config
```

show system

Use the `show system` command to display the up time, system name, location, and contact person.

Syntax

```
show system
```

Example

```
X330WAN-2DS1-1(super)# show system
```

```
Uptime d,h:m:s
```

```
-----
```

```
0,2:40:55
```

System Name	System Location	System Contact
-----	-----	-----
P332_version-3.0.5	Alpha LAB	Ygdal Naouri

show tftp download software status

Use the `show tftp download software status` commands to display the status of the current TFTP Device Manager S/W (Embedded Web) download process into the device.

Syntax

```
show tftp download software status
```

Example

```
X330WAN-2DS1-1(super)# show tftp download software status
```

```
Module #1
```

```
=====
```

```
Module           : 1
Source file      : d:\p340sw\gt-ml\3.5.18\p340.web
Destination file : EW_Archive
Host             : 149.49.70.61
Running state    : Writing ...
Failure display  : (null)
Last warning     : No-warning
```

show tftp download/upload status

Use the `show tftp download status` and `show tftp upload status` commands to display the status of the current TFTP configuration file copy process to/from the device.

Syntax

```
show tftp {download|upload} status
```

Example

```
X330WAN-2DS1-1(super)# show tftp upload status  
Module           : 1  
Source file      : stack-config  
Destination file : c:\conf.cfg  
Host             : 149.49.36.200  
Running state    : Executing  
Failure display  : (null)  
Last warning     : No-warning
```

show time

Use the `show time` command to display the current device time.

Syntax

```
show time
```

Example

```
X330WAN-2DS1-1(super)# show time  
10:32:34 27 JAN 2000 GMT
```

show time parameters

Use the `show time parameters` command to display the time status and parameters.

Syntax

```
show time parameters
```

Example

```
X330WAN-2DS1-1(super)# show time parameters  
Client status: Enabled  
Current time : L:01:38:31 01 JAN 1970 GMT  
Timezone set to 'GMT', offset from UTC is 0 hours  
Time-Server  : 0.0.0.0 (I.e. broadcast address)  
Time acquired from Time-Server: 0.0.0.0  
Time protocol set to           : TIME protocol
```

show timezone

Use the `show timezone` command to display the current device timezone.

Syntax

```
show timezone
```

Example

```
X330WAN-2DS1-1(super)# show timezone  
Timezone set to 'GMT', offset from UTC is 0 hours
```

sync time

Use the `sync time` command to synchronize the time.

Syntax

```
sync time
```

Example

```
X330WAN-2DS1-1(super)# sync time  
Time has been distributed.
```

tech

Use the `tech` command to enter tech mode. This command is reserved for service personnel use only.

terminal length

Use the `terminal length` command to set the length of the terminal display in characters.

Syntax

```
terminal length [<screen-length>]
```

Parameters

`screen-length` **none** - Displays the current length.
 number - Sets the new screen length to the value.

Example

```
X330WAN-2DS1-1(super)# terminal length 24
```

terminal width

Use the `terminal width` command to set the width of the terminal display in characters.

Syntax

```
terminal width [<character>]
```

Parameters

`character` **none** - Displays the current width.
 number - Sets the new screen width to the value.

Example

```
X330WAN-2DS1-1 (super) # terminal width 6
```

Console (RS232) Interface CLI Commands

This section contains a list of all Console interface related CLI commands.

async mode interactive (Console interface context)

Use the `async mode interactive` command to enter modem mode every time the proprietary modem cable is plugged into the Console port.

Syntax

```
async mode interactive
```

async mode terminal (Console interface context)

Use the `async mode terminal` command to disable interactive mode on the Console, disabling the use of PPP and entering terminal mode.

Syntax

```
async mode terminal
```

async reset-modem (Console interface context)

Use the `async reset-modem` command to reset the connected modem.

Syntax

```
async reset-modem
```

interface Console

Use the `interface Console` command to enter the Console interface (`interface console` context) to PPP configure mode. For LAN interfaces, use this command to create the interface. The `no` form of this command sets the default Console parameters.

Syntax

[no] interface Console

Example

```
X330WAN-2DS1-1(configure)# interface Console
```

ppp authentication (Console interface context)

Use the `ppp authentication` command to set the type of password that should be sent for authentication, if necessary.

Syntax

ppp authentication {pap|chap|none}

Parameters

- `pap` Password Authentic Protocol. Unencrypted password sent for authentication.
- `chap` Challenge Handshake Authentication Protocol. Encrypted password sent for authentication.
- `none` No password sent.

Example

To select the CHAP authentication protocol:

```
X330WAN-2DS1-1(config-if:CON)# ppp authentication chap
```

speed (Console context)

Use the `speed` command to set the PPP baud rate to be used by asynchronous PPP ports.



Note:

1. This command is executed from the Console interface.
 2. The peer baud-rate must be set to the same value.
-

Syntax

speed {9600|19200|38400}

Parameters

9600	Sets a speed of 9600 bits per second.
19200	Sets a speed of 19200 bits per second.
38400	Sets a speed of 38400 bits per second.

Example

```
X330WAN-2DS1-1(config-if:CON) # speed 9600
```

timeout absolute (Console interface context)

Use the `timeout absolute` command to set the number of minutes until the system automatically disconnects an idle PPP incoming session.

Syntax

```
timeout absolute <time>
```

Parameters

`time` Number of minutes from 0 to 999, where 0 indicates that no timeout should occur.

Fast Ethernet Interface CLI Commands

This section contains a list of all Fast Ethernet interface related CLI commands.

autoneg (FastEthernet interface context)

Use the `autoneg` command to set the port speed and duplex to auto-negotiation mode for the external Fast Ethernet port. The `no` form of this command disables auto-negotiation mode.

Syntax

```
[no] autoneg
```

duplex (FastEthernet interface context)

Use the `duplex` command to control the duplex setting for the interface.



Note: This command functions only in `no autoneg` mode.

Syntax

duplex {full|half}

Parameters

full	Full duplex.
half	Half duplex.

Example

```
X330WAN-2DS1-1(config-if:FastEthernet1)# duplex full
```

interface FastEthernet

Use the `interface FastEthernet` command to create and/or enter interface Fast Ethernet context. For LAN interfaces, use this command to create the interface. The `no` form of this command deletes an IP interface.

Syntax

[no] interface FastEthernet [interface number [.ip-interface]]

Parameters

interface number	An integer with a value of 1.
ip-interface	The IP interface number within this interface (a number of IP interfaces may be bound to a Layer 3 interface). An integer from 0 to 1024.

Example

```
X330WAN-2DS1-1(configure)# interface FastEthernet 1  
X330WAN-2DS1-1(configure)# interface FastEthernet 1.1  
X330WAN-2DS1-1(configure)# no interface FastEthernet 1.1
```

speed (FastEthernet interface context)

Use the `speed` command to control the speed setting for the interface.



Note: This command is executed from the Fast Ethernet interface.



Note: This command functions only in `no autoneg` mode.

Syntax

speed {10MB|100MB}

Parameters

10MB	Sets a speed of 10 Mbps.
100MB	Sets a speed of 100 Mbps.

Example

```
X330WAN-2DS1-1(config-if:FastEthernet1)# speed 100MB
```

FabricFast Ethernet Interface CLI Commands

This section contains a list of all FabricFast Ethernet interface related CLI commands.

interface FabricFastEthernet

Use the `interface FabricFastEthernet` command to create and/or enter `interface FabricFastEthernet` context. For LAN interfaces, use this command to create the interface. The `no` form of this command deletes a FabricFastEthernet interface or an IP interface.

Syntax

[no] interface FabricFastEthernet [port[:vlan[.ip-interface]]]

Parameters

port	An integer with a value of 1.
vlan	The 802.1q Fabric number, an integer from 1 to 3071.

`ip-interface` The IP interface number within this interface (as a number of IP interfaces might be bound to an Layer 3 interface). An integer from 0 to 1024.

Example

```
X330WAN-2DS1-1(configure)# interface FabricFastEthernet 1
```

```
X330WAN-2DS1-1(configure)# interface FabricFastEthernet 1:1
```

```
X330WAN-2DS1-1(configure)# no interface FabricFastEthernet 1.1
```

To enter interface `FabricFastEthernet` context for port 1, vlan 1, with an IP-interface of 1:

```
X330WAN-2DS1-1(configure)# interface FabricFastEthernet 1:1.1
```

Controller CLI Commands (X330WAN-2DS1 Only)

This section contains a list of all Controller related CLI commands.

cablelength long (Controller context)

Use the `cablelength long` command to configure transmit and receive levels for a cable length (line build-out) longer than 655 feet for a T1 trunk with a CSU interface. This command configures the levels using gain/attenuation. The `no` form of this command restores the `cablelength long` parameters to their default values (Tx=0db level, Rx=gain26).



Note: This command can only be performed if the controller is set to T1.

Syntax

```
[no] cablelength long {gain26|gain36} {-15db|-22.5db|-7.5db| 0db}
```

Parameters

- | | |
|----------------------|---|
| <code>gain26</code> | Sets the receive sensitivity to 26 dB if you can configure the hardware's receive sensitivity. This is the default value. However, it is recommended to enter <code>gain26</code> so that the CLI entry matches the actual value. |
| <code>gain36</code> | Sets the receive sensitivity to 36 dB if you can configure the hardware's receive sensitivity. |
| <code>-15db</code> | Sets the transmit attenuation to 15 dB. |
| <code>-22.5db</code> | Sets the transmit attenuation to 22.5 dB. |

- 7.5db Sets the transmit attenuation to 7.5 dB.
- 0db Sets the transmit attenuation to 0 dB. This is the default value.



Note: If you can not configure the hardware's receive sensitivity, the receive sensitivity is fixed at 36 dB and is unaffected if you enter `gain26` or `gain36`.

Example

```
X330WAN-2DS1-1(config-controller:1)# no cablelength
```

The following example changes the CLI receive sensitivity to match the actual receive sensitivity of the hardware and adds 15 dB of attenuation to the transmit signal:

```
X330WAN-2DS1-1(config-controller:1)# cablelength long gain36 -15db
```

cablelength short (Controller context)

Use the `cablelength short` command to configure transmit attenuation for a cable length (line build-out) of 655 feet or shorter for a T1 trunk with a DSX-1 interface. This command configures the attenuation using the loop length. The `no` form of this command restores the default value.



Note: This command can only be performed if the controller is set to T1.

Syntax

```
cablelength short {133ft|266ft|399ft|533ft|655ft}
```

Parameters

- 133 Cable length of 0 to 133 feet. This is the default value.
- 266 Cable length of 134 to 266 feet.
- 399 Cable length of 267 to 399 feet.
- 533 Cable length of 400 to 533 feet.
- 655 Cable length of 534 to 655 feet.



Note: The transmit attenuation value is best obtained by experimentation. If the signal received by the far-end equipment is too strong, reduce the transmit level by entering additional attenuation.

Example

To set the transmit attenuation for a cable between 134 and 266 feet long:
`X330WAN-2DS1-1(config-controller:1)# cablelength short 266ft`

channel-group (Controller context)

Use the `channel-group` command to create a channel group (also referred to as a "ds0 bundle"). A channel group can be the underlying interface for a PPP or Frame Relay session.

This command creates a logical interface, which is identified by a physical port number, a colon, and a channel group number. For example, channel group 8 on E1 physical port 2 would be referred to as 2:8 in all places where a channel group is needed as a parameter.

Syntax

`channel-group` <channel-num> **timeslots** <timeslot-list> **speed** {56 | 64}



Note: The Speed option can be used only when the controller is set to T1.

Parameters

<code>channel-num</code>	ID number to identify the channel group. The valid range is from 0 to 23 for T1 lines, and from 0 to 30 for E1 lines.
<code>timeslot-list</code>	Timeslots (DS0s) to include in this channel group. The valid timeslots are: <ul style="list-style-type: none"> • 1 to 24 for T1. • 1 to 31 for E1. Values can be either separated by a "," (to indicate a list) or a "-" (to indicate a range).
54 64	Acceptable speed values.



Note: If you have an active PPP or Frame Relay session over this channel group, a warning is issued.



Note: If you issue this command with an existing `channel-num`, it is assumed that the `timeslot-list` is a list of timeslots that should replace the current list of timeslots already defined for that channel group.



Note: Channel groups, voice groups, and TDM groups all use group numbers. All group numbers configured for channel groups, voice groups, and TDM groups must be unique. For example, you can not use the same group number for a channel group and a TDM group.

Example

```
X330WAN-2DS1-1(config-controller:1)# channel-group 10 timeslots 10-24
X330WAN-2DS1-1(config-controller:1)# channel-group 2 timeslots 5-6,8
```

clear controller counters (X330WAN-2DS1)

Use the `clear controller counters` command to reset the controller counters.

Syntax

```
clear controller counters [<controller number>]
```

Parameters

`controller number` The controller number, an integer.

Example

```
X330W-2DS1-1(super)# clear controller counters 1
```

clock source (Controller context)

Use the `clock source` command to configure the clock source for an E1/ T1 controller. The `no` form of this command returns the value to the default.

Syntax

```
[no] clock source {line|internal}
```

Parameters

<code>line</code>	The controller recovers the external clock from the line and provides the recovered clock to the internal (system) clock generator. This is the default value.
<code>internal</code>	The controller synchronizes itself to the internal (system) clock.



Note: Only one E1/T1 controller at a time can recover the network clock and distribute it to the internal clock generator.

Example

```
X330WAN-2DS1-1(config-controller:1)# clock source internal
X330WAN-2DS1-1(config-controller:1)# no clock source
```

controller

Use the `controller` command to enter the specified controller's mode.



Note: You can not configure one controller as E1 and the other as T1.

Syntax

```
controller { e1 | t1 } <port>
```

Parameters

<code>e1</code>	An E1 port.
<code>t1</code>	A T1 port.
<code>port</code>	The number of the port that is being configured.

Example

```
X330WAN-2DS1-1(configure)# controller E1 2
```

description (Controller context)

Use the `description` command to set the description of the E1/T1 interface. This description appears both in the `ifAlias` and the `circuitIdentifier` MIB values for that interface. The `no` form of this command removes the controller's description.



Note: This command can also be executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] description <desc>
```

Parameters

`desc` A string describing the E1/T1 interface. The string may contain blanks and can be up to 255 characters long.

Example

```
X330WAN-2DS1-1(config-controller:1) # description "E1 controller"  
X330WAN-2DS1-1(config-controller:1) # no description
```

fdl

Use the `fdl` command to define an FDL type. FDL is used to define a remote loopback for the module or to receive the far-end counters.

The `no` form of this command disables the FDL.

**Note:**

1. This command can only be performed if the controller is set to T1.
 2. Use this command only when ESF framing is defined.
-

Syntax

```
[no] fdl <fdl-mode>
```

Parameters

`fdl-mode` `ansi` | `att` | `both`

Example

```
X330WAN-2DS1-1(configure)# fdl ansi
```

framing (X330WAN-2DS1 Controller context)

Use the `framing` command to select the frame type for the E1 or T1 data line. The `no` form of this command sets the controller's framing type to the default value.

Syntax

```
[no] framing <frame-type>
```

Parameters

<code>frame-type</code>	The framing method to use:
• <code>sf</code>	Selects super frame framing (dsx1D4). This is the default value for T1 lines.
• <code>esf</code>	Selects extended super frame framing (dsx1ESF).
• <code>crc4</code>	Selects CRC4 framing (dsx1E1-CRC-MF). This is the default value for E1 lines.
• <code>no-crc4</code>	Selects no-CRC4 framing (dsx1E1-MF).
• <code>unframed</code>	The line is not framed.



Note: Use this command in configurations where the router or access server is intended to communicate with an E1 or T1 fractional data line. The service provider determines which framing type (`sf`, `esf`, or `crc4`) is required for your E1/T1 circuit.

Example

```
X330WAN-2DS1-1(config-controller:1)# no framing
```

The following example selects extended super frame as the T1 frame type:

```
X330WAN-2DS1-1(config-controller:1)# framing esf
```

idle-character (X330WAN-2DS1 Controller context)

Use the `idle-character` command to set the bit pattern used to indicate an idle line. The `no` form of this command restores marks as the idle line indicator (default).

Syntax

```
[no] idle-character {flags|marks}
```

Parameters

flags Flags are transmitted to indicate an idle line.

marks Marks (all ones) are transmitted to indicate an idle line. This is the default.

Example

```
X330W-2DS1-1 (super-if:Serial2) # idle-character marks
```

linecode (Controller context)

Use the `linecode` command to select the line-code type for an E1 or T1 line. The `no` form of the command restores the default line-code type of transmission.

Syntax

For T1 lines:

```
linecode {ami|b8zs}
```

For E1 lines:

```
linecode {ami|hdb3}
```

Parameters

ami Alternate Mark Inversion line-code type. Valid for both T1 and E1 controllers.

b8zs B8ZS line-code type. Valid only for a T1 controller. This is the default value for T1 lines.

hdb3 High-Density Bipolar 3 line-code type. Valid only for a E1 controller. This is the default value for E1 lines.



Note: Use this command in configurations where the router or access server must communicate with E1 or T1 fractional data lines. The T1 service provider determines which line-code type, `ami` or `b8zs`, is required for your T1 circuit. The E1 service provider determines which line-code type, `ami` or `hdb3`, is required for your E1 circuit.

Example

```
X330WAN-2DS1-1 (config-controller:1) # no linecode
```

The following example specifies B8ZS as the line-code type for a T1 line:

```
X330WAN-2DS1-1 (config-controller:1) # linecode b8zs
```

loopback diag (Controller context)

Use the `loopback diag` command to put the T1 or E1 line into loopback mode.



Note: Use this command during line setup and maintenance.



Note: Only one type of loopback can be defined at any given time.

Syntax

loopback diag

loopback local (Controller context)

Use the `loopback local` command to put the T1 or E1 line into loopback mode.



Note: Use this command during line setup and maintenance.



Note: Only one type of loopback can be defined at any given time.

Syntax

loopback local {line|payload}

Parameters

<code>line</code>	The controller loops the external line signal back towards the network without reframing the DS1 signal.
<code>payload</code>	The controller loops the external line signal back towards the network and reframes the DS1 signal.

Example

```
X330WAN-2DS1-1(config-controller:1)# loopback local line
```

loopback remote (Controller context)

Use the `loopback remote` command to ask the device on the far end to put itself into loopback mode.



Note:

1. This command can only be performed if the controller is set to T1.
 2. Use this command during line setup and maintenance.
-

Syntax

```
loopback remote {line|payload}
```

Parameters

<code>line</code>	The controller loops the external line signal back towards the network without reframing the DS1 signal.
<code>payload</code>	The controller loops the external line signal back towards the network and reframes the DS1 signal. (This option is available in the ESF framing mode and only when FDL is defined.)

Example

```
X330WAN-2DS1-1(config-controller:1)# loopback remote line
```

no channel group (Controller context)

Use the `no channel group` command to delete a channel group.

Syntax

```
no channel-group <channel-num>
```

Parameters

<code>channel-num</code>	ID number to identify the channel group. The valid range is from 0 to 23 for T1 lines, and from 0 to 30 for E1 lines.
--------------------------	---

Example

```
X330WAN-2DS1-1(config-controller:1)# no channel-group 2
```

no loopback (Controller context)

Use the `no loopback` command to disable the loopback mode.

Syntax

```
no loopback
```

remote (Controller context)

Use the `remote` command to reset the far-end counters.



Note:

1. This command can only be performed if the controller is set to T1.
2. This command is used only when the `fdl at&t` option is defined.

Syntax

```
remote <fdl-request-type>
```

Parameters

<code>fdl-request-type</code>	Reset Performance Monitoring Counters Reset Errored ESF Data
-------------------------------	--

Example

```
X330WAN-2DS1-1(super)# remote Reset-errored-ESF-data
```

show controllers

Use the `show controllers` command to display the status of the controller.

Syntax

```
show controllers [<port>]
```

Parameters

<code>port</code>	The port number.
-------------------	------------------

Output Example for E1

```
X330WAN-2DS1-1(configure)# show controllers
```

```
E1 1 is up.
  No alarms detected.
  Framing is CRC4, Line Code is HDB3, Clock Source is
  Line.
  channel-group 1 timeslots 1-31
  Data in current interval (778 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0
  Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err
  Secs, 0 Unavail Secs
```

```
Total Data (last 92 15 minute intervals):
  19958 Line Code Violations, 38 Path Code Violations
  0 Slip Secs, 5 Fr Loss Secs, 6 Line Err Secs, 0
  Degraded Mins
  6 Errored Secs, 1 Bursty Err Secs, 5 Severely Err
  Secs, 0 Unavail Secs
E1 2 is administratively down.
```

Output Example for T1

```
T1 1 is down.
  Cablelength is long gain26 0db.
  Transmitter is sending remote alarm.
  Receiver has loss of signal.
  Framing is SF, Line Code is AMI, Clock Source is Line.
  channel-group 1 timeslots 1-6
  Data in current interval (347 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0
    Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err
    Secs, 0 Unavail Secs
  Total Data (last 24 hours):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0
    Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err
    Secs, 0 Unavail Secs
```



Note: When this command is used with the `port` parameter, information about all statistics intervals is displayed.

The following are the `show controllers` command output fields:

Field	Description
T1 1 is down	Displays that the T1 controller 1 is not operating. The controller's state can be up, down, or administratively down. Loopback conditions are shown either as being locally looped or remotely looped.
Cablelength	Displays the current line buildout. Relevant for T1 lines only.

Remote alarm	<p>Any alarms detected by the controller are displayed. The possible alarms are:</p> <ul style="list-style-type: none"> • Transmitter is sending remote alarm. • Transmitter is sending alarm indication signal (AIS). • Receiver has loss of signal. • Receiver is receiving AIS. • Receiver has loss of frame. • Receiver has remote alarm. • Receiver has no alarms. • Receiver has a major alarm.
Framing	Shows the current framing type. The default framing type for E1 is CRC4. The default framing type for T1 is SF.
Line Code	Displays the current line code. The default line code for E1 is HDB3. The default line code for T1 is AMI.
Clock Source	Displays the current clock source. The possible clock sources are either Line or Internal.
Channel Group	Displays the channel group number and timeslots.
Data in current interval (347 seconds elapsed)	Displays the current accumulation period (from 1-900 seconds), which rolls into a 24 hour accumulation every 15 minutes. The oldest 15 minute period falls off the back of the 24 hour accumulation buffer.
Line Code Violations	Displays either no line code violations, the occurrence of a Bipolar Violation, or the occurrence of an Excessive Zeros error event.
Path Code Violations	<p>Displays one of the following:</p> <ul style="list-style-type: none"> • No path code violations. • A frame synchronization bit error in the SF (for T1) and no- CRC4 (for E1) frame types. • A CRC4 error in the ESF (for T1) and CRC4 (for E1) frame types.
Slip Secs	Displays if there is a replication or deletion of the payload bits of a domestic trunk interface (DS1) frame. A slip might happen when there is a difference between the timing of a synchronous receiving terminal and the received signal.
Fr Loss Secs	Displays the number of seconds an Out of Frame (OOF) error is detected.

Line Err Secs	Displays the number of seconds one or more Line Code Violations are detected.
Degraded Mins	Displays the number of minutes during which the estimated error rate is between 1E-6 and 1E-3.
Errored Secs	<p>In ESF (T1) and CRC4 (E1) links, displays the number of seconds when one of the following is detected:</p> <ul style="list-style-type: none">• One or more path code violations.• One or more Out of Frame defects.• One of more Controlled Slip events.• An AIS defect. <p>In SF (T1) and no-CRC4 (E1) links, displays the presence of bipolar violations.</p>
Bursty Err Secs	<p>Displays the number of seconds with:</p> <ul style="list-style-type: none">• Path Coding Violation errors (between 1 and 320).• No Severely Errored Frame defects.• No detected incoming AIS defects. <p>The number of controlled slips is not displayed.</p>
Severly Err Secs	<p>For ESF (T1) signals, displays the number of seconds one of the following is detected:</p> <ul style="list-style-type: none">• 320 or more Path Code Violation Errors.• One or more Out of Frame defects.• An AIS defect. <p>For SF (T1) signals, displays the number of seconds one of the following is detected:</p> <ul style="list-style-type: none">• 1544 Line Code Violations.• A count of one second intervals with Framing Errors.• An Out of Frame defect. <p>For CRC (E1) signals, displays the number of seconds one of the following is detected:</p> <ul style="list-style-type: none">• 832 or more Path Code Violation errors.• One or more Out of Frame defects. <p>For no-CRC (E1) signals, displays the number of seconds with 2048 or more Line Code Violations.</p>
Unavail Secs	Displays the total number of seconds on the interface, calculated by counting the number of seconds that the interface is unavailable.

show controllers remote

Use the `show controllers remote` command to display far end performance data through an FDL message.



Note: This command is used when the `fdl at&t` option is defined.

Syntax

```
show controllers remote <port> <fdl-request-type>
```

Parameters

<code>port</code>	The number of the port.
<code>fdl-request- type</code>	Request types include: <ul style="list-style-type: none"> • 1h-data. • Enhanced-CI-configuration. • Enhanced-1h. • Errored-ESF-data.

Example

```
X330WAN-2DS1-1 (super) # show controllers remote 1 1h-data
```

shutdown (Controller context)

Use the `shutdown` command to shutdown the E1/T1 link. This has the effect of administratively bringing the line down. In effect, it sends a 'blue alarm' on the line. The `no` form of this command reconnects the E1/T1 link.

Syntax

```
[no] shutdown
```

Interface Serial CLI Commands

This section contains a list of all Interface Serial related CLI commands.

backup delay (Serial interface context)

Use the `backup delay` command to set the switchover delay in case of failure.

Syntax

```
backup delay <failure delay> <secondary disable delay>
```

Parameters

<code>failure delay</code>	The switchover delay to the backup interface, in seconds. The default is 0.
<code>secondary disable delay</code>	The revert to primary time, in seconds. The default is 0. This value can also be set to never.

Example

```
backup delay 0 60
```

backup interface (Serial interface context)

Use the `backup interface` command to set a backup interface.

Syntax

```
backup interface <interface-type> <interface-number>
```

Parameters

<code>interface-type</code>	The interface type, a string.
<code>interface-number</code>	The interface number.

Example

```
backup interface Serial 1:1
```

clear ip rtp header-compression

Use the `clear ip rtp header-compression` command to clear RTP compression statistics either for all enabled interfaces or for a specific interface. To clear for all enabled interfaces, do not enter an interface type and number.

Syntax

```
clear ip rtp header-compression [<interface type> <interface number>]
```

Parameters

<code>interface type</code>	The type of interface.
<code>interface number</code>	The interface number.

Example

```
X330WAN-2USP-1 (super) # clear ip rtp header-compression
```


clear ip tcp header-compression (PPP interface)

Use the `clear ip tcp header-compression` command to clear TCP compression statistics either for all enabled interfaces or for a specific interface. To clear for all enabled interfaces, do not enter an interface type and number.

Syntax

```
clear ip tcp header-compression [<interface type> <interface number>]
```

Parameters

`interface type` The type of interface.

`interface number` The interface number.

Example

```
X330WAN-2USP-1(super)# clear ip tcp header-compression
```

description (X330WAN-2USP Serial interface context)

Use the `description` command to set the description of the interface. The `no` form of this command removes the interface's description.



Note: This command can also be executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] description <desc>
```

Parameters

`desc` A string describing the interface, up to 80 characters.

Example

```
X330WAN-2DS1-1(config-if:FastEthernet1)# description vlan5
```

idle-character (X330WAN-2USP Serial interface context)

Use the `idle-character` command to set the bit pattern used to indicate an idle line. The `no` form of this command restores flags as the idle line indicator (default).

Syntax

```
[no] idle-character {flags|marks}
```

Parameters

flags	Flags are transmitted to indicate an idle line. This is the default.
marks	Marks (all ones) are transmitted to indicate an idle line.

Example

```
X330W-2USP-1 (super-if:Serial2) # idle-character marks
```

ignore-dcd (X330WAN-2USP Serial interface context)

Use the `ignore-dcd` command to configure the serial interface to monitor the DSR/CTS signals instead of the DCD signal as the line up/down indicator. The `no` form of this command restores DCD monitoring as the line status indicator (default).

Syntax

```
[no] ignore-dcd
```

Example

```
X330W-2USP-1 (super-if:Serial2) # ignore-dcd
```

interface Serial (X330WAN-2DS1)

Use the `interface Serial` command to create and/or enter interface `Serial` context. For LAN interfaces, use this command to create the interface. The `no` form of this command deletes an IP interface.

Syntax

```
[no] interface Serial <if-number>[<if-link-type>]
```

Parameters

`if-number` Comprised of: `port:channel-group[.ip-interface|sub-interface[.ip-interface]]`.

- `port` The controller number (port number) for this serial port. For the X330W-2DS1, this value is either 1 or 2.
- `channel-group` An integer. For E1, between 0 and 30; for T1, between 0 and 23.
- `ip-interface` The IP interface number within this interface (as a number of IP interfaces might be bound to a Layer 3 interface). An integer from 0 to 1024.

`if-link-type` Point-to-point.

Example

To enter interface serial mode port 1, channel group 3 in ip-interface 1:

```
X330W-2DS1(configure)# interface Serial 1:3
```

IP interface for PPP encapsulation:

```
interface Serial 1:3.1
```

Sub interface for frame-relay encapsulation:

```
interface Serial 1:3.1 point-to-point
```

IP interface for frame-relay encapsulation:

```
interface Serial 1:3.1.1
```

interface Serial (X330WAN-2USP)

Use the `interface Serial` command to create and/or enter interface Serial context. For LAN interfaces, use this command to create the interface. The `no` form of this command deletes an IP interface.

Syntax

```
[no] interface Serial <if-number> [<if-link-type>]
```

Parameters

<code>if-number</code>	Comprised of: port [.ip-interface sub-interface[.ip-interface]].
<code>port</code>	The controller number (port number) for this serial port. For the X330W-2DS1, this value is either 1 or 2.
<code>sub-interface</code>	The Sub-interface number. An integer from 0 to 1024.
<code>ip-interface</code>	The IP interface number within this interface (as a number of IP interfaces might be bound to a Layer 3 interface). An integer from 0 to 1024.
<code>if-link-type</code>	Point-to-point.

Example

To enter interface serial mode port 1:

```
X330W-2USP(super)# interface Serial 1
```

IP interface for PPP encapsulation:

```
interface Serial 1.1
```

Sub interface for frame-relay encapsulation:

```
interface Serial 1.1 point-to-point
```

IP interface for frame-relay encapsulation:

```
interface Serial 1.1.1
```

invert txclock (X330WAN-2USP)

Use the `invert txclock` command to invert the transmit clock signal (TxC) from the DCE. This signal is used by the DTE in transmitting data. The `no` form of this command returns the signal to 'not inverted'.

Syntax

```
[no] invert txclock
```

Example

```
X330WAN-2USP(configure)# invert txclock
```

load-interval (Serial interface context)

Use the `load-interval` command to set the load-calculation interval for an interface.

The syntax for this command is:

```
load-interval <seconds>
```

`seconds` DTR low time, in milliseconds (an integer from 30 to 600). The default is 300.



Note: The load interval must be in increments of 30 seconds.

Example

```
X330W-2USP-1(super-if:Serial2)# load-interval 60
```

loopback (X330WAN-2USP Serial interface context)

Use the `loopback` command to activate a Loopback signal on the Serial interface. This action creates a loop in the DCE. The `no` form of this command deactivates the loopback (default).

Syntax

```
[no] loopback
```

Example

```
X330W-2USP-1(super-if:Serial2)# loopback
```

mtu (Serial interface context)

Use the `mtu` command to set the interface Maximum Transmission Unit (MTU). The `no` form of this command restores interface MTU to the default value (1500).

Syntax

```
[no] mtu <size in bytes>
```

Parameters

`size in bytes` An integer from 64 to 1500.

Example

```
X330WAN-2DS1-1(config-if:Serial1:1)# mtu 1000
```

nrzi-encoding (X330WAN-2USP Serial interface context)

Use the `nrzi-encoding` command to enable the non-return-to-zero inverted (NRZI-space) line-coding format on the interface. The `no` form of this command disables NRZ encoding (default).

Syntax

```
[no] nrzi-encoding
```

Example

```
X330W-2USP-1(super-if:Serial2)# nrzi-encoding
```

queue-limit (Serial interface context)

Use the `queue-limit` command to set the packet size of the various queues.

Syntax

```
[no] queue-limit <queue id> <size>
```

Parameters

`queue id` The queue priority ID (1 - highest, 4 - lowest).

`size` The size of the queue, in packets. The total number of packets in all queues can not exceed 5000.

Example

```
X330WAN-2DS1-1(config-if:Serial1:1)# queue-limit 1 200
```

show ip rtp header-compression

Use the `show ip rtp header-compression` command to display all RTP compression statistics either for a specific interface or for all enabled interfaces.



Note: To display the statistics for all enabled interfaces, do not enter an interface name.

Syntax

```
show ip rtp header-compression [<interface name>]
```

Parameters

interface name The interface name.

Example

```
X330WAN-2DS1-1(configure)# show ip rtp header-compression Serial 1:1
IP RTP header compression statistics:
Interface Serial 1:2:
  Rcvd: 1 Full Headers, 13194 Compressed, 0 Errors
  Sent: 2 Full Headers, 209 Compressed,
        7508 Bytes Saved, 5996 Bytes Sent,
        2.25 Efficiency Improvement Factor
  Connect: Active, 16 Rx Slots, 16 Tx Slots,
           Max Time 5, Max Period 256
Interface Serial 1:3.1:
  Rcvd: 0 Full Headers, 0 Compressed, 0 Errors
  Sent: 0 Full Headers, 0 Compressed,
        0 Bytes Saved, 0 Bytes Sent,
        1.00 Efficiency Improvement Factor
  Connect: Inactive, 16 Rx Slots, 16 Tx Slots,
           Max Time 5, Max Period 256
```

show ip rtp header-compression brief

Use the `show ip rtp header-compression brief` command to display a summary of all RTP compression statistics either for a specific interface or for all enabled interfaces.



Note: To display the statistics for all enabled interfaces, do not enter an interface name.

Syntax

```
show ip rtp header-compression brief [<interface name>]
```

Parameters

interface name The interface name.

Example

```
X330WAN-2DS1-1(configure)# show ip rtp header-compression brief
```

```
Serial 1:1
```

```
Showing 2 rows
```

Interface	Active	Slots	Max Time	Max Period	Packets Sent	Bytes Saved	Improvement Factor
Serial 1:2	YES	16	5	256	211	7508	2.25
Serial 1:3.1	NO	16	5	256	0	0	1.00

show ip tcp header-compression

Use the `show ip tcp header-compression` command to display the TCP decompression statistics for a specific interface or all enabled interfaces.



Note: To display the statistics for all enabled interfaces, do not enter an interface name.

Syntax

```
show ip tcp header-compression [<interface name>]
```

Parameters

interface name The interface name.

Example

```
X330WAN-2DS1-1(configure)# show ip tcp header-compression Serial 1:1
IP TCP header compression statistics:
Interface Serial 1:2:
  Rcvd: 11 Full Headers, 89 Compressed, 0 Errors
  Connect: Active, 16 Rx Slots, 16 Tx Slots,
           Max Time 5, Max Period 256
```

show ip tcp header-compression brief

Use the `show ip tcp header-compression brief` command to display a summary of all TCP decompression statistics either for a specific interface or all enabled interfaces.



Note: To display the statistics for all enabled interfaces, do not enter an interface name.

Syntax

```
show ip tcp header-compression brief [<interface name>]
```

Parameters

interface name The interface name.

Example

```
X330WAN-2DS1-1(configure)# show ip tcp header-compression brief
Serial 1:1
Showing 1 rows
Interface Active Slots    Max    Max
                               Time Period
-----
Serial 1:2    YES    16    5    256
```

show queueing

Use the `show queueing` command to display the priority queue size, in packets.

Syntax

```
show queueing [Serial <if-number>]
```

Parameters

`if-number` The port number of this interface, either 1 or 2.

Example

```
X330WAN-2DS1-1 (super) # show queueing Serial 1
```

shutdown (X330WAN-2USP Serial interface context)

Use the `shutdown` command to shutdown the selected interface. The `no` form of this command activates the selected interface.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and Console interfaces.

Syntax

```
[no] shutdown
```



Note: The `no shutdown` option is not available in the Console interface.

transmitter-delay (X330WAN-2USP Serial interface context)

Use the `transmitter-delay` command to set the minimum number of flags needed to recognize the end of one data frame. The `no` form of this command restores the default value, 0 flags, which is the shared flag mode.

Syntax

```
[no] transmitter-delay <number>
```

Parameters

`number` An integer from 0-15. The minimum number of flags for recognizing the end of one data frame and the beginning of the next.

Example

```
X330W-2USP-1 (super-if:Serial2) # transmitter-delay 2
```

voip-queue (Serial interface context)

Use the `voip-queue` command to select custom queueing and queue sizes for VoIP traffic. The `no` form of this command restores the default priority queue's size to the default.

Syntax

```
[no] voip-queue
```

Frame Relay Configuration CLI Commands

This section contains a list of all Frame Relay configuration related CLI commands.

bc out (Map-class context)

Use the `bc out` command to set the committed burst size for the map-class Frame Relay. The `no` form of this command restores the default value.

Syntax

```
[no] bc out <bits>
```

Parameters

`bits` The burst size in bits. The default is 7000 bits.

Example

```
X330WAN-2USP-1 (super-map-class) # bc out 6000
```

be out (Map-class context)

Use the `be out` command to set the excess burst size for the map-class Frame Relay. The `no` form of this command restores the default value.

Syntax

```
[no] be out <bits>
```

Parameters

`bits` The burst size in bits. The default is 0 bits.

Example

```
X330WAN-2USP-1 (super-map-class) # be out 6000
```

cir out (Map-class context)

Use the `cir out` command to set the CIR for the map-class Frame Relay. The `no` form of this command restores the default value (56000 bps).

Syntax

```
[no] cir out <bits>
```

Parameters

bits The CIR in bits per second (bps).

Example

```
X330WAN-2USP-1(super-map-class) # cir out
```

clear frame-relay counters

Use the `clear frame-relay counters` command to clear the Frame Relay counters.

Syntax

```
clear frame-relay counters
```

Example

```
X330WAN-2USP-1(super) # clear frame-relay counters
```

de-buffer-size (Frame Relay Serial interface context)

Use the `de-buffer-size` command to set the buffer size for frames marked as drop-eligible.

Syntax

```
[no] de-buffer-size <size>
```

Parameters

size The drop-eligible (DE) buffer size in packets.

Example

```
X330WAN-2USP-1(super-map-class) # de-buffer-size 200
```

de pre-mark (Map-class context)

Use the `de pre-mark` command to set the threshold, in percent of CIR, for pre-marking of non-high priority traffic. The `no` form of this command restores the default value.



Note: This command is relevant when voice and data traffic share a single Virtual Circuit. A higher threshold value provides more bandwidth for data traffic, potentially reducing voice quality. Too low a value might provide more bandwidth to voice traffic than is needed, and the data traffic is discarded. You obtain the exact threshold value for your uses via trial and error.

Syntax

```
[no] de pre-mark <threshold-percent>
```

Parameters

`threshold-percent` The threshold, in percent of CIR. The default is 100%.

Example

```
X330WAN-2USP-1(super-map-class)# de pre-mark 35
```

encapsulation frame-relay (Serial interface context)

Use the `encapsulation frame-relay` command to set the encapsulation of the Serial interface to a Frame-Relay interface. The `no` form of this command reverts the encapsulation of the Serial interface to PPP.



Note: PPP is the default encapsulation.

Syntax

```
[no] encapsulation frame-relay [<type>]
```

Parameters

`type` The type of encapsulation: `ietf`.

Example

```
X330W-2USP-1(super-if:Serial2)# encapsulation frame-relay ietf
```

fragment (Map-class context)

Use the `fragment` command to set the fragment size. If you do not enter a value, the default value is used. The `no` form of this command restores the default value.

Syntax

```
[no] fragment <value>
```

Parameters

value The fragment size in bytes. The default is 88 bytes.

Example

```
X330WAN-2USP-1(super-map-class) # fragment 35
```

frame-relay class-dlci (Serial sub-interface context)

Use the `frame-relay class-dlci` command to define a map-class to a DLCI on a sub-interface. The `no` form of this command deletes the map-class of a DLCI on the sub-interface.

Syntax

```
[no] frame-relay class-dlci <DLCI number> <map-class-name>
```

Parameters

DLCI number The DLCI number to assign a map-class, an integer from 16 to 1007.

map-class-name The DLCI map-class name, a string of characters.

Example

```
X330W-2USP-1(super-if:Serial2.1) # frame-relay class-dlci 16 voip
```

frame-relay interface-dlci (Serial sub-interface context)

Use the `frame-relay interface-dlci` command to define the Primary DLCI on a sub-interface. The `no` form of this command deletes the Primary DLCI on the sub-interface.

Syntax

```
[no] frame-relay interface-dlci <DLCI number>
```

Parameters

DLCI number The DLCI number, an integer from 16 to 1007.

Example

```
X330W-2USP-1(super-if:Serial2.1)# frame-relay interface-dlci 20
```

frame-relay lmi-type (Serial interface context)

Use the `frame-relay lmi-type` command to set the type of LMI to be used. The `no` form of this command sets the LMI to the default value `AutoSense`, for automatically determining the LMI type.

Syntax

```
[no] frame-relay lmi-type <lmi-type>
```

Parameters

lmi-type The LMI type, either `AutoSense`, `ansi`, `q933a`, `lmi-rev1`, or `disable`. The default is `AutoSense`.

Example

```
X330W-2USP-1(super-if:Serial2)# frame-relay lmi-type AutoSense
```



Note: Choosing the `disable` option results in no LMI being used. This is equivalent to setting `no keepalive` within the Serial interface context.

frame-relay lmi-n391dte (Serial interface context)

Use the `frame-relay lmi-n391dte` command to set the full status polling counter. The `no` form of this command sets the polling counter to the default value (6).

Syntax

```
[no] frame-relay lmi-n391dte <polling-counter>
```

Parameters

polling-counter The number of partial status enquiries, an integer from 1 to 255.

Example

```
X330W-2USP-1(super-if:Serial2)# frame-relay lmi-n391dte 20
```

frame-relay lmi-n392dte (Serial interface context)

Use the `frame-relay lmi-n392dte` command to set the LMI error threshold. The `no` form of this command sets the error threshold to the default value (3).

Syntax

```
[no] frame-relay lmi-n392dte <threshold>
```

Parameters

`threshold` The error threshold value, an integer from 1 to 10.

Example

```
X330W-2USP-1(super-if:Serial2)# frame-relay lmi-n392dte 6
```

frame-relay lmi-n393dte (Serial interface context)

Use the `frame-relay lmi-n393dte` command to set the monitored event count. The `no` form of this command sets the monitored event count to the default value (4).

Syntax

```
[no] frame-relay lmi-n393dte <events>
```

Parameters

`events` The monitored error count value, an integer from 1 to 10.



Note: Set the value for this counter greater than the `lmi-n392dte` value.

Example

```
X330W-2USP-1(super-if:Serial2)# frame-relay lmi-n393dte 8
```

frame-relay priority-dlci-group (Serial sub-interface context)

Use the `frame-relay priority-dlci-group` command to define a priority group of DLCIs on a sub-interface. The `no` form of this command deletes the priority group of DLCIs on the sub-interface.

Syntax

```
[no] frame-relay priority-dlci-group <DLCI1> [<DLCI2> [<DLCI3>  
[<DLCI4>]]]
```

Parameters

- DLCI1 The DLCI assigned to high priority traffic, an integer from 16 to 1007.
- DLCI2 The DLCI assigned to medium priority traffic, an integer from 16 to 1007.
- DLCI3 The DLCI assigned to normal priority traffic, an integer from 16 to 1007.
- DLCI4 The DLCI assigned to low priority traffic, an integer from 16 to 1007.

Example

```
X330W-2USP-1(super-if:Serial2.1)# frame-relay priority-dlci-group 16 17 18 19
```



Note: If you specify less than four DLCIs, the last DLCI specified is automatically used for the missing priorities.

frame-relay traffic-shaping (Serial interface context)

Use the `frame-relay traffic-shaping` command to enable traffic shaping. The `no` form of this command disables traffic shaping.

Syntax

```
[no] frame-relay traffic-shaping
```

Example

```
X330W-2USP-1(super-if:Serial2)# frame-relay traffic-shaping
```

keepalive (Serial interface context Frame Relay encapsulation)

Use the `keepalive` command to enable sending the LMI t391dte status requests. The `no` form of this command disables LMI.

Syntax

```
[no] keepalive [<Seconds>]
```

Parameters

- Seconds The number of seconds between status requests (an integer from 5 to 30). Entering `keepalive` without a parameter returns the `keepalive` to its default of 10 seconds. Entering `keepalive 0` or `no keepalive` disables LMI.

Example

```
X330W-2USP-1 (super-if:Serial2) # keepalive 10
```



Note: Entering `keepalive 0` or setting `no keepalive` is equivalent to choosing the `disable` option in the `frame-relay lmi-type` command.

map-class frame-relay

Use the `map-class frame-relay` command to enter the map-class Frame Relay context. In this context you configure the map-class QoS. Use the `no` form of this command to delete a map class

Syntax

```
[no] map-class frame-relay <map-class-name>
```

Parameters

`map-class-name` The name of the map-class, a string.

Example

```
X330WAN-2USP-1 (super) # map-class frame-relay voip
```

show frame-relay fragment

Use the `show frame-relay fragment` command to display the Frame Relay fragment statistics.

Syntax

```
show frame-relay fragment [interface <interface name>|<dldci number>]
```

Parameters

`interface name` The name of the interface whose statistics are to be displayed.

`dldci number` The DLCI number, an integer from 16 to 1007.

Example

```
X330WAN-2USP-1 (super) # show frame-relay fragment
```

show frame-relay lmi

Use the `show frame-relay lmi` command to display the Frame Relay LMI statistics.

Syntax

```
show frame-relay lmi [interface <interface name>]
```

Parameters

`interface name` The name of the interface whose statistics are to be displayed.

Example

```
X330WAN-2USP-1(super)# show frame-relay lmi
LMI Statistics for interface Serial 1 (Frame Relay DTE)
LMI TYPE = Auto Detect Mode
  Invalid Unnumbered info      0,      Invalid Prot Disc      0
  Invalid dummy Call Ref      0,      Invalid Msg Type      0
  Invalid Status Message      0,      Invalid Lock Shift    0
  Invalid Information ID      0,      Invalid Report IE Len 0
  Invalid Report Request      0,      Invalid Keep IE Len   0
  Num Status Enq. Sent        0,      Num Status msgs Rcvd  0
  Num Update Status Rcvd      0,      Num Status Timeouts   0
```

The following is a description of the `show frame-relay lmi` output fields:

Field	Description
LMI TYPE	The signalling or LMI specification: detected ANSI, detected ITU-T, or Auto Detect mode.
Invalid Unnumbered info	The number of LMI messages received with invalid, unnumbered information fields.
Invalid Prot Disc	The number of LMI messages received with invalid protocol discriminators.
Invalid dummy Call Ref	The number of LMI messages received with invalid dummy call references.
Invalid Msg Type	The number of LMI messages received with invalid message types.
Invalid Status Message	The number of LMI messages received with invalid status messages.

Field	Description
Invalid Lock Shift	The number of LMI messages received with invalid lock shift types.
Invalid Information ID	The number of LMI messages received with invalid information identifiers.
Invalid Report IE Len	The number of LMI messages received with invalid Report IE Lengths.
Invalid Report Request	The number of LMI messages received with invalid Report Requests.
Invalid Keep IE Len	The number of LMI messages received with invalid Keep IE Lengths.
Num Status Enq. Sent	The number of LMI Status Inquiry messages sent.
Num Status msgs Rcvd	The number of LMI Status Inquiry messages received.
Num Update Status Rcvd	The number of LMI Asynchronous Update Status Inquiry messages received.
Num Status Timeouts	The number of times the status message was not received within the Keepalive time value.

show frame-relay map

Use the `show frame-relay map` command to display the Frame Relay map table.

Syntax

```
show frame-relay map
```

Example

```
X330WAN-2USP-1(super)# show frame-relay map
```

```
Interface          State  Interface Type DLCI  DLCI  Type  DLCI  State
-----
```

show frame-relay pvc

Use the `show frame-relay pvc` command to display the Frame Relay PVC statistics.

Syntax

```
show frame-relay pvc [interface <interface name>|<dlci number>]
```

Parameters

`interface name` The name of the interface whose statistics are to be displayed.

`dlci number` The DLCI number, an integer from 16 to 1007.

Example

```
X330WAN-2USP-1(super)# show frame-relay pvc 16
```

show frame-relay pvc brief

Use the `show frame-relay pvc brief` command to display a summary of the Frame Relay PVC statistics.

Syntax

```
show frame-relay pvc brief
```

Example

```
X330WAN-2USP-1(super)# show frame-relay pvc brief
```

show frame-relay traffic

Use the `show frame-relay traffic` command to display the Frame Relay protocol statistics.

Syntax

```
show frame-relay traffic
```

Example

```
X330WAN-2USP-1(super)# show frame-relay traffic
```

Frame Relay statistics:

ARP requests sent	0,	ARP replies sent	0
ARP requests recvd	0,	ARP replies recvd	0

show map-class frame-relay

Use the `show map-class frame-relay` command to display the map-class Frame Relay table.

Syntax

show map-class frame-relay

Example

```
X330WAN-2USP-1(super)# show map-class frame-relay
```

```
Showing 1 frame-relay map-class entry
```

Map Class Name	CIR	BC	BE	De Pre-Mark	Fragment
default	56000	7000	0	100%	0

PPP Configuration CLI Commands

This section contains a list of all PPP configuration related CLI commands.

ip tcp decompression-connections (PPP interfaces)

Use the `ip tcp decompression-connections` command to set the number of TCP decompression connections. The `no` form of this command restores the default.

Syntax

[no] ip tcp decompression-connections [<number>]

Parameters

number The number of TCP decompression connections, an integer from 3-256. The default is 16.

Example

```
X330WAN-2USP(super)# ip tcp decompression-connections 20
```

keepalive (Serial interface context PPP encapsulation)

Use the `keepalive` command to enable PPP keepalive. The `no` form of this command disables PPP keepalive.

Syntax

[no] keepalive [<Seconds>]

Parameters

Seconds The number of seconds between PPP keepalive messages (an integer from 0 to 32767). Entering `keepalive` without a parameter returns the `keepalive` to its default of 10 seconds. Entering `keepalive 0` disables `keepalive`.

Example

```
X330W-2USP-1(super-if:Serial2)# keepalive 300
```

ppp timeout ncp (Serial interface context)

Use the `ppp timeout ncp` command to set the maximum time, in seconds, that the PPP should allow for negotiation of a network layer protocol. The `no` form of this command disables the maximum time that the PPP should allow for negotiation.

Syntax

```
[no] ppp timeout ncp <Seconds>
```

Parameters

Seconds The maximum time, in seconds, PPP should allow for negotiation of a network layer protocol. If no network protocol is negotiated within the given time, the connection is terminated. An integer from 1 to 65535.

Example

```
X330WAN-2DS1-1(config-if:Serial1:1)# ppp timeout ncp 10
```

ppp timeout retry (Serial interface context)

Use the `ppp timeout retry` command to set the maximum time, in seconds, to wait for a response during PPP negotiation. The `no` form of this command restores the maximum time to wait for a response during PPP negotiation to the default value (2 seconds).

Syntax

```
[no] ppp timeout retry <Seconds>
```

Parameters

Seconds The maximum time, in seconds, to wait for a response during PPP negotiation. An integer from 1 to 255.

Example

```
X330WAN-2DS1-1(config-if:Serial1:1)# ppp timeout retry 10
```

Loopback CLI Commands

This section contains a list of all Loopback related CLI commands.

interface Loopback

Use the `interface Loopback` command to create and/or enter interface Loopback context. The `no` form of this command deletes a Loopback interface or an IP interface.

Syntax

```
[no] interface Loopback [<interface number>[.ip-interface]]
```

Parameters

<code>interface number</code>	An integer from 0 to 99.
<code>ip-interface</code>	The IP interface number within this interface (a number of IP interfaces may be bound to a Layer 3 interface). An integer from 0 to 1024.

Example

```
X330WAN-2DS1-1 (configure)# interface Loopback 1
X330WAN-2DS1-1 (configure)# interface Loopback 1.0
X330WAN-2DS1-1 (configure)# no interface Loopback 1.0
```

General Layer 2 Interface CLI Commands

This section contains a list of all general Layer 2 related CLI commands.

bandwidth (X330WAN-2USP Interface context)

Use the `bandwidth` command to set the bandwidth informational parameter for the interface. The `no` form of this command sets the bandwidth informational parameter to the default value.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] bandwidth [<kilobits>]
```

Parameters

`kilobits` The bandwidth for the interface, an integer from 1 to 10000000, in kilobits per second. The default bandwidth for Frame Relay is 2048.

Example

```
X330WAN-2DS1-1(super-if:FabricFastEthernet1:1)# bandwidth 100
```

clear counters

Use the `clear counters` command to clear Layer 2 interface counters.

Syntax

```
clear counters [<type> <identifier>]
```

Parameters

`type` The interface type, a string.

`identifier` The interface identifier.

Example

```
X330W-2USP-1(super)# clear counters Serial 1:2
```

default-metric (Interface context)

Use the `default-metric` command to set the RIP metric value.

Syntax

```
default-metric <rip interface metric>
```

Parameters

`rip interface metric` An integer from 1 to 15.

Example

```
X330WAN-2USP-1(super-router:rip)# default-metric 3
```

show interfaces

Use the `show interfaces` command to display information on all interfaces in the X330WAN, starting at the first Layer 2 interface. If the type is specified, only interfaces of that type are shown. If no type is specified, all interfaces are shown.

Syntax

```
show interfaces [<type>] [<identifier>]
```


Parameters

- type** The type of this interface. Select one of the following:
FastEthernet, Serial, FabricFastEthernet, Loopback, or Console.
- identifier**
- For a FastEthernet interface — An integer (1).
 - For a Serial interface — <port>:<channel-group> (for PPP)
or <port> (for Frame Relay).
 <port> — Either 1 or 2.
 <channel-group> — For E1, an integer, 0-30.
 For T1, an integer, 0-23.
 - For a FabricFastEthernet interface — 1[:<vlan>]
 <vlan> - An integer, 1-3071.
 - For a Loopback interface — An integer, 1-99.



Note: This command has different outputs for PPP and Frame Relay, and for X330W-2DS1 and X330W-2USP. Two output examples are provided.

Output Example for X330W-2DS1 with PPP on both controllers:

```
X330WAN-2DS1-1(super)# show interfaces
FabricFastEthernet 1 is up, line protocol is up
MTU 1500 bytes, Bandwidth 100000 Kbit
Reliability 255/255 txLoad 1/255 rxLoad 1/255
Encapsulation ARPA
Link status trap disabled
Full-duplex, 100Mb/s
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:00:00, Last output 00:00:08
Last clearing of 'show interface' counters 00:06:24
5 minute input rate 81966 bits/sec, 155 packets/sec
5 minute output rate 8 bits/sec, 0 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
115 packets input, 7360 bytes
115 broadcasts received, 0 giants
0 input errors, 0 CRC
4 packets output, 256 bytes
0 output errors, 0 collisions
FabricFastEthernet 1:1 is up, line protocol is up
Physical address is 00.40.0d.bf.20.01,
Internet address is 4.0.0.1, mask is 255.0.0.0
```

```
MTU 1500 bytes, Bandwidth 100000 Kbit
Reliability 255/255 txLoad 1/255 rxLoad 1/255
Encapsulation ARPA
Link status trap disabled
Full-duplex, 100Mb/s
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:00:00, Last output 00:00:08
Last clearing of 'show interface' counters 00:06:24
5 minute input rate 81966 bits/sec, 155 packets/sec
5 minute output rate 8 bits/sec, 0 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
115 packets input, 7360 bytes
115 broadcasts received, 0 giants
0 input errors, 0 CRC
4 packets output, 256 bytes
0 output errors, 0 collisions
FastEthernet 1 is up, line protocol is up
Physical address is 00.40.0d.bf.20.fe,
MTU 1500 bytes, Bandwidth 10000 Kbit
Reliability 255/255 txLoad 1/255 rxLoad 1/255
Encapsulation ARPA
Link status trap disabled
Half-duplex, 10Mb/s, 10BaseTX
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, Last output never
Last clearing of 'show interface' counters 00:06:24
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
0 packets input, 0 bytes
0 broadcasts received, 0 giants
0 input errors, 0 CRC
0 packets output, 0 bytes
0 output errors, 0 collisions
Loopback 1 is up, line protocol is up
Internet address is 111.1.1.1, mask is 255.0.0.0
MTU 1514 bytes, Bandwidth 8000000 Kbit
Reliability 255/255 txLoad 1/255 rxLoad 1/255
Encapsulation LOOPBACK
Link status trap enabled
Last input never, Last output never
```

```
Last clearing of 'show interface' counters never.
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
0 packets input, 0 bytes
0 broadcasts received, 0 giants
0 input errors, 0 CRC
0 packets output, 0 bytes
0 output errors, 0 collisions
Serial 1:1 is down, line protocol is down
MTU 1500 bytes, Bandwidth 704 Kbit
Reliability 1/255 txLoad 1/255 rxLoad 1/255
Encapsulation PPP
Link status trap disabled
Keepalive set (10 sec)
LCP Starting
IPCP Initial
Last input never, Last output never
Last clearing of 'show interface' counters 00:06:24
VoIP mode disabled.
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
0 packets input, 0 bytes
0 broadcasts received, 0 giants
0 input errors, 0 CRC, 0 abort
0 packets output, 0 bytes
0 output errors, 0 collisions
Serial 2:1 is up, line protocol is up
Internet address is 30.0.0.2, mask is 255.0.0.0
Primary management interface
(advertised IPCP)
MTU 1500 bytes, Bandwidth 640 Kbit
Reliability 255/255 txLoad 8/255 rxLoad 1/255
Encapsulation PPP
Link status trap disabled
Keepalive not set
LCP Opened
IPCP Opened
Last input 00:05:39, Last output 00:00:08
Last clearing of 'show interface' counters 00:06:24
```

```
VoIP mode disabled.
5 minute input rate 358 bits/sec, 0 packets/sec
5 minute output rate 17792 bits/sec, 40 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
4 packets input, 256 bytes
0 broadcasts received, 0 giants
0 input errors, 0 CRC, 0 abort
8 packets output, 384 bytes
0 output errors, 0 collisions
Serial 2:2 is up, line protocol is up
Internet address is 60.0.0.2, mask is 255.0.0.0
(advertised IPCP)
MTU 1500 bytes, Bandwidth 640 Kbit
Reliability 255/255 txLoad 1/255 rxLoad 1/255
Encapsulation PPP
Link status trap disabled
Keepalive not set
LCP Opened
IPCP Opened
Last input 00:06:03, Last output 00:00:08
Last clearing of 'show interface' counters 00:06:24
VoIP mode disabled.
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 1 bits/sec, 0 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
3 packets input, 192 bytes
0 broadcasts received, 0 giants
0 input errors, 0 CRC, 0 abort
7 packets output, 320 bytes
0 output errors, 0 collisions
Console asynchronous mode is terminal
Terminal baud rate is 9600
```

Output Example of X330W-2USP with Frame Relay encapsulation sub-interfaces defined:

```
X330WAN-2USP-1(super)# show interfaces Serial
Serial 1 is down, line protocol is down
MTU 1500 bytes, Bandwidth 2048 Kbit
Reliability 1/255 txLoad 1/255 rxLoad 1/255
Encapsulation FRAME-RELAY IETF, loopback not set
Link status trap disabled
LMI enq sent 0, LMI stat recvd 0, LMI upd recvd 0, DTE LMI down
```

```
LMI DLCI 0, LMI type is ANSI Annex D, frame relay DTE
Last input never, Last output never
Last clearing of 'show interface' counters 00:59:21
VoIP mode disabled.
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
0 packets input, 0 bytes
0 broadcasts received, 0 giants
0 input errors, 0 CRC, 0 abort
0 packets output, 0 bytes
0 output errors, 0 collisions ,0 carrier transitions
DCD = down DSR = down DTR = up RTS = up CTS = down
Serial 2 is up (partially), line protocol is up
MTU 1500 bytes, Bandwidth 2048 Kbit
Reliability 255/255 txLoad 1/255 rxLoad 1/255
Encapsulation FRAME-RELAY IETF, loopback not set
Link status trap disabled
LMI enq sent 374, LMI stat recvd 373, LMI upd recvd 0, DTE LMI up
LMI DLCI 0, LMI type is ANSI Annex D (Auto Detected), frame relay DTE
Last input 00:00:01, Last output 00:00:01
Last clearing of 'show interface' counters 00:59:21
VoIP mode disabled.
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 19 bits/sec, 0 packets/sec
0 input drops, 0 output drops, 0 unknown protocols
356 packets input, 5284 bytes
0 broadcasts received, 0 giants
0 input errors,0 CRC, 0 abort
378 packets output, 5688 bytes
0 output errors, 0 collisions, 0 carrier transitions
DCD = up DSR = up DTR = up RTS = up CTS = up
Serial 2.1 is up, line protocol is up
Internet address is 5.0.0.1, mask is 255.0.0.0
Primary management interface
MTU 1500 bytes, Bandwidth 2048 Kbit
Encapsulation FRAME-RELAY IETF, loopback set
Link status trap disabled
Last input never, Last output 00:00:38
Last clearing of 'show interface' counters 00:59:21
0 input drops, 0 output drops, 0 unknown protocols
```

```
0 packets input, 0 bytes
0 broadcasts received, 0 giants
0 input errors, 0 CRC, 0 abort
22 packets output, 704 bytes
0 output errors, 0 collisions
Serial 2.2 is down, line protocol is down
Internet address is 1.0.0.1, mask is 255.0.0.0
MTU 1500 bytes, Bandwidth 2048 Kbit
Encapsulation FRAME-RELAY IETF, loopback not set
Link status trap disabled
Last input never, Last output never
Last clearing of 'show interface' counters 00:59:21
0 input drops, 0 output drops, 0 unknown protocols
0 packets input, 0 bytes
0 broadcasts received, 0 giants
0 input errors, 0 CRC, 0 abort
0 packets output, 0 bytes
0 output errors, 0 collisions
```

The following is a description of the `show interfaces` output fields:

Field	Description
Serial, Fast Ethernet, FabricFast Ethernet, or Loopback	Indicates if the port is up or down. This value also indicates if the interface is partially up, meaning that some of the sub-interfaces are down.
Line protocol	Indicates if the line is functional. This is monitored by keepalive packets.
Primary Management Interface	Displays the interface configured as Primary Management.
Physical address	The MAC address (for Fabric and Ethernet interfaces).
IP address mask	The IP address assigned to the interface.
MTU	The Maximum Transmission Unit of the interface.
BW	The Bandwidth of the interface in Kbps.

Field	Description
Reliability	The average interface availability, where the maximum=255/255, and the minimum=1/255.
Tx load	The transmitter traffic average bandwidth utilization, where the maximum=255/255, and the minimum=1/255.
Rx load	The received traffic average bandwidth utilization, where the maximum=255/255, and the minimum=1/255.
Encapsulation	The encapsulation method assigned to the interface.
Loopback	Displays if the loopback mode is set for the interface.
Link Status Trap	Displays if this trap is enabled for this interface.
Last input	Displays the time elapsed since the last packet was received on this interface (in hh:mm:ss).
Last output	Displays the time elapsed since the last packet was transmitted via this interface (in hh:mm:ss).
Last clearing of show interface counters	Displays the time elapsed since the interface counters were last cleared.
VoIP mode enabled/disabled	Displays the status of the VoIP mode on this interface (PPP and Frame Relay interfaces).
Input drops	Displays the number of entering Rx packets dropped due to WRED and congestion in the Rx queues.
Output drops	Displays the number of Tx packets dropped due to WRED and congestion in the Tx queues, as well as the Frame Relay Policy.
'n' minute input rate	The average number of bits and packets received in the last 'n' minutes, where 'n' is set using the <code>load interval</code> command. This does not appear for sub-interfaces.
'n' minute output rate	The average number of bits and packets transmitted in the last 'n' minutes, where 'n' is set using the <code>load interval</code> command. This does not appear for sub-interfaces.
Packets input	The total number of packets received without error.
Bytes input	The total number of bytes in the packets received without error, including data and MAC encapsulation packets.

Field	Description
Received broadcasts	The amount of broadcasts received. This value advances only for Ethernet interfaces.
Received giants	Displays the number of packets discarded due to them exceeding the maximum packets size.
Received unknown protocols	Displays the number of packets received on the interface that were discarded due to them using an unknown or unsupported protocol.
Input errors	The total number of errors for packets received. Includes a sum of the following errors.
CRC	The Cyclic Redundancy Checksum. This usually indicates transmission problems on the data link.
Abort	An illegal sequence of 1 bit was detected on a Serial interface. This usually indicates a clocking problem.
Packets output	The total number of messages transmitted.
Bytes output	The total number of bytes transmitted, including data and MAC encapsulation packets.
Output errors	The total number of errors that prevented packets from being transmitted.
Collisions	Displays the number of retransmitted messages due to an Ethernet collision (non-Ethernet ports=0).
Interface resets	The number of DTR and RTS resets (down-up fluctuation) due to an inoperable Serial line, or when the USP interface is administratively brought up again (USP interfaces only).
Carrier transitions	The number of times the carrier detect signal state changes on a Serial interface.
Signal status	DCD, DSR, DTR, RTS, and CTS signal status (X330W-2USP only).
ARP type	The Address Resolution Protocol type used.
ARP timeout	The Address Resolution Protocol timeout value.
Full/Half duplex	The duplex state of the interface (for Fabric and Fast Ethernet interfaces only).

Field	Description
100Mb/s, 10Mb/s	The Fast Ethernet speed.
Backup interface	Indicates if this interface is used as a backup interface for another.
Failure delay	The time in seconds between the Primary interface going down and the Backup interface activation.
Secondary disable delay	The time in seconds between the Primary interface restoration and the Backup interface deactivation.
LMI enq sent	The number of t391 status requests sent (Frame Relay interfaces only).
LMI stst recvd	The number of status messages received from the DCE (Frame Relay interfaces only).
LMI upd recvd	The number of LMI updates received from the DCE (Frame Relay interfaces only).
DTE LMI down/up	The status of the LMI. After the first message is received from the DCE, the status is up (Frame Relay interfaces only).
LMI DLCI	The DLCI used for the LMI messages (Frame Relay interfaces only).
LMI type	The LMI type (Frame Relay interfaces only).
Frame relay DTE/DCE	The module type (Frame Relay interfaces only).



Note: In rare cases, the sub-frame relay traffic information presented by this command can include packets that are eventually dropped before transmission.

snmp trap link-status (Serial and Fast Ethernet interface contexts)

Use the `snmp trap link-status` command to enable Link Up and Link Down traps. The `no` form of this command deactivates the traps for the interface. By default the link-status trap generation is disabled.

Syntax

```
[no] snmp trap link-status
```

Example

```
snmp trap link-status
```

Layer 3 CLI Commands

This section contains a list of all Layer 3 related CLI commands.

arp

Use the `arp` command to add a permanent entry to the Address Resolution Protocol (ARP) cache. The `no` form of this command removes an entry, either a static entry or a dynamically learned entry.

Syntax

```
[no] arp <ip-address> <mac-address>
```

Parameters

<code>ip-address</code>	IP address, in dotted decimal format, of the station.
<code>mac-address</code>	MAC address of the local data link.

Example

To add a permanent entry for station 192.168.7.8 to the ARP cache:

```
Router (configure)# arp 192.168.7.8 00:40:0d:8c:2a:01
```

To remove an entry from the ARP cache for the station 192.168.13.76:

```
Router (configure)# no arp 192.168.13.76
```

arp timeout

Use the `arp timeout` command to configure the amount of time that an entry remains in the ARP cache. To restore the default value, 14400, use the `no` form of this command.

Syntax

```
[no] arp timeout <seconds>
```

Parameters

<code>seconds</code>	The amount of time, in seconds, that an entry remains in the ARP cache. Maximum value is 604800.
----------------------	--

Example

To set the ARP timeout to one hour:

```
X330WAN-2DS1-1 (configure)# arp timeout 3600
```

To restore the default ARP timeout:

```
Router-N (configure)# no arp timeout
```

clear arp-cache

Use the `clear arp-cache` command to delete all dynamic entries from the ARP cache and the IP route cache.

Syntax

```
clear arp-cache [<vlan>|<ip addr> [<mask>]]
```

Parameters

<code>vlan</code>	VLAN string (up to 16 characters) or VLAN ID number.
<code>ip addr</code>	IP address.
<code>mask</code>	IP mask.

Example

<code>clear arp-cache</code>	Flush all ARP entries.
<code>clear arp-cache "FabricFastEthernet 1:1"</code>	Flush ARP entries for a VLAN.
<code>clear arp-cache 30</code>	Flush ARP entries for a VLAN ID.
<code>clear arp-cache 192.168.0.0 255.255.0.0</code>	Flush range of ARP entries belonging to one subnet.

clear fragment

Use the `clear fragment` command to clear the fragment database and restore its defaults.



Note: No IP reassembly is performed on packets in transit through the router.

Syntax

```
clear fragment
```

clear ip route

Use the `clear ip route` command to delete all the dynamic routing entries from the routing table.

Syntax

```
clear ip route * | <ip-addr> [<ip-mask>]
```

`ip-addr` IP address.

`ip-mask` IP mask address.

Example

```
clear ip route *           Clears the entire routing table.  
clear ip route 192.168.49.1 255.255.255.0  Clears a range of entries.
```

clear ip traffic

Use the `clear ip traffic` command to clear the IP counters.

Syntax

```
clear ip traffic
```

Example

```
X330WAN-2DS1-1 (super) # clear ip traffic
```

default-metric (Interface context)

Use the `default-metric` command to set the interface Routing Information Protocol (RIP) route metric value. The `no` form of this command restores the default value (1).



Note: This command is executed from the Loopback, Serial, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] default-metric <number>
```

Parameters

`number` The interface route metric value. The range is 1 to 15.

Example

```
X330WAN-2DS1-1 (configure:interface) # default-metric 10
```

default-metric (Router-OSPF context)

Use the `default-metric` command to set the default metric of redistributed routes. The `no` form of this command restores the default. The default metric is 20.

Syntax

```
[no] default-metric <default metric>
```

Parameters

`default metric` An integer from 1 to 65535.

Example

```
X330WAN-2DS1-1(configure router:ospf)# default-metric 50
```

default-metric (Router-RIP Mode)

Use the `default-metric` command to set the default metric of redistributed routes. The `no` form of this command restores the default. The default metric is 1.

Syntax

```
[no] default-metric <default metric>
```

Parameters

`default metric` The interface RIP route metric value. The range is 1 to 16.

Example

```
X330WAN-2DS1-1(configure router:rip)# default-metric 5
```

distribution-list (Router-RIP Mode)

Use the `distribution-list` command to filter incoming/outgoing networks in route updates. The `no` form of this command deactivates the filter.

Syntax

```
[no] distribution-list <access-list-number> <type> [<interface-type><interface-number>|<protocol>]
```

Parameters

<code>access-list-number</code>	An integer from 1 to 99.
<code>type</code>	[in out]
<code>interface-type</code>	The interface type, a string.
<code>interface-number</code>	The interface number.
<code>protocol</code>	[static ospf] Protocol is only relevant for outgoing (out) list entries.

Example

```
X330WAN-2DS1-1(configure router:rip)# distribution-list 10 in  
"FabricFastEthernet 1"  
X330WAN-2DS1-1(configure router:rip)# distribution-list 20 out  
"Serial 1:1"  
X330WAN-2DS1-1(configure router:rip)# distribution-list 40 out ospf
```

fragment chain

Use the `fragment chain` command to set the maximum number of fragments that can comprise a single IP packet destined to the router. The `no` form of this command sets the fragment chain to the default value (64).



Note: No IP reassembly is performed on packets in transit through the router.

Syntax

```
[no] fragment chain <chain-limit>
```

Parameters

<code>chain-limit</code>	The maximum number of fragments that can comprise a single IP packet, from 2 to 2048. The default is 64.
--------------------------	--

Example

```
X330WAN-2DS1-1(configure)# fragment chain 30
```

fragment size

Use the `fragment size` command to set the maximum number of fragmented IP packets, destined to the router, to reassemble at any given time. The `no` form of this command sets the fragment size to the default value (100).



Note: No IP reassembly is performed on packets in transit through the router.

Syntax

```
[no] fragment size <database-limit>
```

Parameters

`database-limit` The maximum number of packets undergoing re-assembly at any given time, from 0 to 200. The default is 100.

Example

```
X330WAN-2DS1-1(configure)# fragment size 150
```

fragment timeout

Use the `fragment timeout` command to set the maximum number of seconds to reassemble a fragmented IP packet destined to the router. The `no` form of this command sets the fragment timeout to the default value (10).



Note: No IP reassembly of packets in transit through the router is performed.

Syntax

```
[no] fragment timeout <timeout>
```

Parameters

`timeout` The maximum number of seconds to re-assemble an IP packet, from 5 to 120. The default is 10.

Example

```
X330WAN-2DS1-1(configure)# fragment timeout 30
```

ip address

Use the `ip address` command to assign an IP address and mask to an interface. The `no` form of the command deletes an IP interface.

Syntax

```
[no] ip address <ip-address> <mask> [<admin-state>]
```

Parameters

<code>ip address</code>	The IP address assigned to the interface.
<code>mask</code>	Mask for the associated IP subnet.
<code>admin-state</code>	The administration status, i.e., either up or down (default is up). This parameter is not applicable for the Console interface of the X330WAN.

Example

To assign the IP address 192.168.22.33 with mask 255.255.255.0 to the Fast Ethernet interface:

```
X330WAN-2DS1-1 (super-if:FastEthernet1) # ip address 192.168.22.33 24
```

ip admin-state (Interface context)

Use the `ip admin-state` command to set the administrative state of an IP interface. The default state is **up**.

Syntax

```
ip admin-state <up/down>
```

Parameters

<code>up/down</code>	Administrative state of the interface. The choices are Up (active) or Down (inactive).
----------------------	--

ip bootp-dhcp network (Interface context)

Use the `ip bootp-dhcp network` command to select the network from which the BOOTP/DHCP server should allocate an address. This command is required only when there are multiple IP interfaces over the FabricFastEthernet. The `no` form of this command restores the default.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip bootp-dhcp network <ip net>
```

Parameters

ip net The IP subnet.

Example

To select the network 192.168.169.0 as the network from which an address should be allocated for BOOTP/DHCP requests:

```
X330WAN-2USP-1(super-if:FabricFastEthernet1:20)# ip bootp-dhcp  
network 192.168.169.0
```

ip bootp-dhcp relay

Use the `ip bootp-dhcp relay` command to enable relaying of BOOTP and DHCP requests to the BOOTP/DHCP server. The `no` form of this command disables BOOTP/DHCP relay. The default state is **disabled**.

Syntax

```
[no] ip bootp-dhcp relay
```

Example

To enable relaying of BOOTP and DHCP requests:

```
X330WAN-2DS1-1(configure)# ip bootp-dhcp relay
```

To disable relaying of BOOTP and DHCP requests:

```
X330WAN-2DS1-1(configure)# no ip bootp-dhcp relay
```

ip bootp-dhcp server (Interface context)

Use the `ip bootp-dhcp server` command to add a BOOTP/DHCP server to handle BOOTP/DHCP requests received by this interface. A maximum of two servers can be added to a single interface. The `no` form of this command removes the server.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip bootp-dhcp server <ip-address>
```

Parameters

`ip-address` The IP address of the server.

Example

To add station 192.168.37.46 as a BOOTP/DHCP server to handle BOOTP/DHCP requests:

```
X330WAN-2DS1-1(configure)# ip bootp-dhcp server 192.168.37.46
```

ip broadcast-address (Interface context)

Use the `ip broadcast-address` command to update the interface broadcast address.



Note: This command is executed from the Serial, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
ip broadcast-address <bc addr>
```

Parameters

`bc addr` The broadcast IP address.

Example

```
ip broadcast-address 192.168.255.255
```

ip default-gateway

Use the `ip default-gateway` command to define a default gateway (router). The `no` form of this command removes the default gateway.

Syntax

```
[no] ip default-gateway {<ip-address> | <interface-type> <interface-number>} [<cost>] [<preference>] [permanent]
```

Parameters

`ip-address` The IP address of the router.

`interface-type` The interface type.

`interface-number` The interface name.

`cost` The path cost. The default is 1.

preference	Preference, either High or Low. The default is Low.
permanent	The route is not disabled if the interface is down.

Example

```
X330WAN-2DS1-1 (super) # ip default-gateway 132.55.4.45 4 high
X330WAN-2DS1-1 (super) # ip default-gateway Serial 1:1 permanent
X330WAN-2DS1-1 (super) # no ip default-gateway
```

ip directed-broadcast (Interface context)

Use the `ip directed-broadcast` command to enable net-directed broadcast forwarding. The `no` form of this command disables net-directed broadcasts on an interface.



Note: This command is executed from the Serial, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip directed-broadcast
```

ip distribution access-default-action

Use the `ip distribution access-default-action` command to set the default action for a specific Policy list.

Syntax

```
ip distribution access-default-action <list-number> <default-action>
```

Parameters

list-number	An integer from 1 to 99.
default-action	default-action-deny default-action-permit

Example

```
X330WAN-2DS1-1 (configure) # ip distribution access-default-action 1
default-action-deny
```

ip distribution access-list

Use the `ip distribution access-list` command to create a distribution Policy statement.

Syntax

```
ip distribution access-list <policy-list-number>  
<access-list-index> <action>  
{<dest-ip> [<dest-wildcard>]|any}
```

Parameters

<code>policy-list-number</code>	An integer from 1 to 99.
<code>access-list-index</code>	An integer.
<code>action</code>	<code>permit deny</code>
<code>dest-ip</code>	IP network address.
<code>dest-wildcard</code>	IP network wildcard address.
<code>any</code>	Enter if the value can be any destination IP.

Example

```
X330WAN-2DS1-1(configure)# ip distribution access-list 1 23 deny  
10.10.0.0 0.0.255.255  
X330WAN-2DS1-1(configure)# ip distribution access-list 2 24 permit  
10.1.1.1  
X330WAN-2DS1-1(configure)# ip distribution access-list 20 4 permit  
any
```

ip distribution access-list-cookie

Use the `ip distribution access-list-cookie` command to set the cookie list.

Syntax

```
ip distribution access-list-cookie <list-id> <cookie>
```

Parameters

<code>list-id</code>	An integer from 1 to 99.
<code>cookie</code>	An integer.

Example

```
X330WAN-2DS1-1(configure)# ip distribution access-list-cookie 4 12345
```

ip distribution access-list-copy

Use the `ip distribution access-list-copy` command to copy the distribution access-list.

Syntax

```
ip distribution access-list-copy <source-list> <destination-list>
```

Parameters

`source-list` An integer from 1 to 99.

`destination-list` An integer from 1 to 99.

Example

```
X330WAN-2DS1-1(configure)# ip distribution access-list-copy 1 3
```

ip distribution access-list-name

Use the `ip distribution access-list-name` command to set the distribution list name.

Syntax

```
ip distribution access-list-name <distribution-list-number> <name>
```

Parameters

`distribution-list-number` An integer from 1 to 99.

`name` List name.



Note: To define a name that includes spaces, enclose the entire name in quotation marks (e.g., "New York").

Example

```
X330WAN-2DS1-1(configure)# ip distribution access-list-name 5  
"evening"
```

ip distribution access-list-owner

Use the `ip distribution access-list-owner` command to set the Policy list owner.

Syntax

```
ip distribution access-list-owner <policy-list-number> <owner>
```

Parameters

<code>policy-list-number</code>	An integer from 1 to 99.
<code>owner</code>	List owner.



Note: To define a name that includes spaces, enclose the entire name in quotation marks (e.g., "New York").

Example

```
X330WAN-2DS1-1 (configure)# ip distribution access-list-owner 78  
"admin"
```

ip icmp-errors

Use the `ip icmp-errors` command to set ICMP error messages ON. The `no` form of this command sets ICMP error messages OFF.

Syntax

```
[no] ip icmp-errors
```

ip max-arp-entries

Use the `ip max-arp-entries` command to specify the maximum number of ARP cache entries allowed in the ARP cache. The `no` form of this command restores to the default value of 4096. This command takes effect only after start-up.

Syntax

```
[no] ip max-arp-entries <value>
```

Parameters

`value` The space available for the IP address table. When you decrease the number of entries, it may cause the table to be relearned more frequently. If you do not enter a value, then the current ARP Cache size is shown. The range of accepted values is 128 to 16384.

Example

To set the maximum number of ARP cache entries to 8000:

```
X330WAN-2DS1-1(configure)# ip max-arp-entries 8000
```

To restore the maximum number of ARP cache entries to its default:

```
X330WAN-2DS1-1(configure)# no ip max-arp-entries
```

ip max-route-entries

The `ip max-route-entries` command exists for compatibility with P550. There is no limitation on the size of the routing table, except for the amount of available memory. The `no` form of this command sets the maximum number of route entries in the routing table to its default value.

Syntax

```
[no] ip max-route-entries <value>
```

Parameters

`value` The number of entries. The range of accepted values is 100 to 20000.

ip netbios-rebroadcast (Interface context)

Use the `ip netbios-rebroadcast` command to set the NETBIOS rebroadcasts mode on an interface. The `no` form of this command disables NETBIOS rebroadcasts on an interface.



Note: This command is executed from the Serial, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip netbios-rebroadcast [<direction>]
```

Parameters

The possible values of `direction` are:

- | | |
|----------------------|---|
| <code>both</code> | NETBIOS packets received on the interface are rebroadcast to other interfaces and NETBIOS packets received on other interfaces are rebroadcast to this interface.
If no parameter is provided in the command, the "both" option is applied as the default. |
| <code>disable</code> | NETBIOS packets are not rebroadcast in or out of this interface. |

Example

To enable rebroadcasting of NETBIOS packets received by and sent from the FastEthernet interface:

```
X330WAN-2DS1-1 (super-if:FastEthernet1) # ip netbios-rebroadcast both
```

ip netmask-format

Use the `ip netmask-format` command to specify the format of netmasks in the `show` command output. The `no` form of this command restores the format to the default, which is a dotted decimal format.

Syntax

```
[no] ip netmask-format <mask-format>
```

Parameters

The possible mask formats are:

- | | |
|--------------------------|---|
| <code>bitcount</code> | Addresses are followed by a slash and the total number of bits in the netmask, such as 17. |
| <code>decimal</code> | The network masks are in dotted decimal notation, such as 255.255.255.0. |
| <code>hexadecimal</code> | The network masks are in hexadecimal format as indicated by the leading 0X, such as 0XFFFFFF00. |

Example

To display netmasks in bitcount format:

```
X330WAN-2DS1-1 (configure) # ip netmask-format bitcount
```

ip ospf authentication-key (Interface context)

Use the `ip ospf authentication-key` command to configure the interface authentication password. The `no` form of this command removes the OSPF password.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip ospf authentication-key <key>
```

Parameters

`key` A string (up to 8 characters).

Example

```
config-if:ip ospf authentication-key my_pass
```

ip ospf cost (Interface context)

Use the `ip ospf cost` command to configure interface metric. The `no` form of this command sets the cost to its default. The default is 1.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip ospf cost <cost>
```

Parameters

`cost` An integer from 1 to 65535.

Example

```
ip ospf cost 10
```

ip ospf dead-interval (Interface context)

Use the `ip ospf dead-interval` command to configure the interval before declaring the neighbor as dead. The `no` form of this command sets the dead-interval to its default. The default is 40.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip ospf dead-interval <seconds>
```

Parameters

seconds An integer from 1 to 415029.

Example

```
ip ospf dead-interval 15
```

ip ospf hello-interval (Interface Mode)

Use the `ip ospf hello-interval` command to specify the time interval between hello packets the router sends. The `no` form of this command sets the hello-interval to its default. The default is 10 seconds.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip ospf hello-interval <seconds>
```

Parameters

seconds An integer from 1 to 65535.

Example

```
ip ospf hello-interval 5
```

ip ospf priority (Interface Mode)

Use the `ip ospf priority` command to configure interface priority used in DR election. The `no` form of this command sets the OSPF priority to its default. The default is a priority of 1.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip ospf priority <priority>
```

Parameters

`priority` An integer from 0 to 255.

Example

```
priority 17
```

ip ospf router-id

Use the `ip ospf router-id` command to configure router identity. The `no` form of this command returns the router identity to its default (lowest IP interface that exists).

Syntax

```
[no] ip ospf router-id <router id>
```

Parameters

`router id` The IP address.

Example

```
X330WAN-2DS1-1(configure)# ip ospf router-id 192.168.49.1
```

ip proxy-arp (Interface context)

Use the `ip proxy-arp` command to enable proxy ARP on an interface. The `no` form of this command disables proxy ARP on an interface.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip proxy-arp
```

Example

```
X330WAN-2DS1-1 (configure)# no ip proxy-arp
```

ip redirects (Interface context)

Use the `ip redirects` command to enable the sending of redirect messages on the interface. The `no` form of this command disables the redirect messages. By default, sending of redirect messages on the interface is enabled.



Note: This command is executed from the Serial, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip redirects
```

Example

```
X330WAN-2DS1-1 (super-if:FastEthernet1)# ip redirects
```

ip rip authentication key (Interface context)

Use the `ip rip authentication key` command to set the authentication string used on the interface. The `no` form of this command clears the password.

Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip rip authentication key <password>
```

Parameters

`password` The authentication string for the interface. Up to 16 characters are allowed.

Example

```
X330WAN-2DS1-1 (configure)# ip rip authentication key hush-hush
```

ip rip authentication mode (Interface context)

Use the `ip rip authentication mode` command to specify the type of authentication used in RIP Version 2 packets. The `no` form of this command restores the default value of `none`.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip rip authentication mode [simple|none]
```

Parameters

`simple|none` The authentication type used in RIP Version 2 packets:

- **simple** - Clear text authentication.
- **none** - No authentication.

Example

```
X330WAN-2DS1-1(configure)# ip rip authentication mode simple
```

ip rip default-route-mode (Interface context)

Use the `ip rip default-route-mode` command to enable learning of the default route received by the RIP protocol. The default state is `talk-listen`. The `no` form of the command disables listening to default routes.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip rip default-route-mode <mode>
```

Parameters

The possible default route modes on an interface are:

`talk-listen` Set RIP to send and receive default route updates on the interface.

`talk-only` Set RIP to send but not receive default route updates on the interface.

Example

```
X330WAN-2DS1-1(configure)# ip rip default-route-mode talk-only
```

ip rip poison-reverse (Interface context)

Use the `ip rip poison-reverse` command to enable split-horizon with poison-reverse on an interface. The `no` form of this command disables the poison-reverse mechanism.

The split-horizon technique prevents information about routes from exiting the router interface through which the information was received. This prevents routing loops.

Poison-reverse updates explicitly indicate that a network or subnet is unreachable. Poison-reverse updates are sent to defeat large routing loops.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip rip poison-reverse
```

ip rip rip-version (Interface context)

Use the `ip rip rip-version` command to specify the RIP version running on the interface basis.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
ip rip rip-version [1|2]
```

Parameters

The possible versions of the RIP packets received and sent on an interface are:

- [1] RIP Version 1 packets.
- [2] RIP Version 2 packets.

Example

To specify that RIP version 2 should be running on the basis of the Serial 1:1 interface:

```
X330WAN-2DS1-1(super-if:Serial:1:1)# ip rip rip-version 2
```

ip rip send-receive (Interface context)

Use the `ip rip send-receive` command to set the RIP send and receive modes on an interface. The default state is talk-listen. The `no` form of this command sets the RIP to talk (i.e., send report).

Syntax

```
[no] ip rip send-receive-mode <mode>[<default route metric>]
```

Parameters

mode	talk-listen - Sets RIP to receive and transmit updates on the interface.
	talkdefault-listen - Sets RIP to receive updates on the interface and send only a default route.
	listen-only - Sets RIP to receive updates on the interface and not transmit them.
default route metric	Integer value.

Example

```
X330WAN-2DS1-1(super-if:Serial:1:1)# ip rip send-receive talk-listen
```

ip rip split-horizon (Interface context)

Use the `ip rip split-horizon` command to enable the split-horizon mechanism. The `no` form of this command disables the split-horizon mechanism. By default split-horizon is enabled.

The split-horizon mechanism prevents information about routes from exiting the router interface through which the information was received. This prevents routing loops.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip rip split-horizon
```

Example

```
X330WAN-2DS1-1(super-if:Serial:1:1)# no ip rip split-horizon
```

ip route

Use the `ip route` command to establish a static route. The `no` form of this command removes a static route.

Syntax

```
[no] ip route <ip addr> <mask> {{<next-hop> [<next-hop> [<next-hop>]]
| <interface-type> <interface-number>} [<cost>] [<preference>]
[permanent] | Null0}
```

Parameters

<code>ip addr</code>	The IP address of the network.
<code>mask</code>	The mask of the static route.
<code>next-hop</code>	The next hop address in the network.
<code>interface-type</code>	The interface type.
<code>interface-number</code>	The interface number.
<code>cost</code>	The path cost. The default is 1.
<code>preference</code>	Preference, either High or Low. Default is Low.
<code>permanent</code>	The route is not disabled if the interface is down.
<code>Null0</code>	Creates a static discard route.

Example

```
X330WAN-2DS1-1(configure)# ip route 132.55.0.0 255.255.0.0
132.55.4.45 3 high
X330WAN-2DS1-1(configure)# no ip route 134.66.0.0 255.255.0.0
X330WAN-2DS1-1(configure)# ip route 134.66.0.0 255.255.0.0 Null0
• For a X330WAN-2DS1:
X330WAN-2DS1-1(configure)# ip route 135.0.0.0 255.0.0.0 Serial 1:1
permanent
• For a X330WAN-2DS1:
X330WAN-2USP-1(configure)# ip route 192.168.12.0 255.255.0.0 Serial 1
```

ip routing

Use the `ip routing` command to enable IP routing. The `no` form of this command disables the IP routing process in the device. By default, IP routing is enabled.

Syntax

```
[no] ip routing
```

ip routing-mode (Interface context)

Use the `ip routing-mode` command to set the IP routing mode of the interface. The IP address used in Avaya MultiService Network Manager is the primary management interface IP address. Only one interface can be in RT_PRIMARY_MGMT mode. By default, the first IP address defined is used as the primary interface.



Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
ip routing-mode <mode>
```

Parameters

`mode` RT_PRIMARY_MGMT mode. In RT-MGMT mode, the interface functions as a routing interface. In RT_PRIMARY_MGMT mode, the interface functions as both a routing interface and a primary management interface.

Syntax

```
ip routing-mode <rt_primary_mgmt>
```

Example

```
X330WAN-2DS1-1(configure)# ip routing-mode RT_PRIMARY_MGMT
```

ip vrrp (Interface context)

Use the `ip vrrp` command to create a virtual router on the interface. The `no` form of this command deletes a virtual router.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip vrrp <vr-id>
```

Parameters

`vr-id` Virtual Router ID, an integer from 1 to 255.

Example

```
X330WAN-2DS1-1(configure)# ip vrrp 1
```

ip vrrp address

Use the `ip vrrp address` command to assign an IP address to the virtual router. The `no` form of this command removes an IP address from a virtual router.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip vrrp <vr-id> address <ip-address>
```

Parameters

<code>vr-id</code>	Virtual Router ID, an integer from 1 to 255.
<code>ip-address</code>	The IP address to be assigned to the virtual router.

Example

To assign address 10.0.1.2 to virtual router 1:

```
X330WAN-2DS1-1(configure)# ip vrrp 1 address 10.0.1.2
```

ip vrrp auth-key

Use the `ip vrrp auth-key` command to set the virtual router simple password authentication for the virtual router ID. The `no` form of this command disables simple password authentication for the virtual router instance.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip vrrp <vr-id> auth-key <key-string>
```

Parameters

<code>vr-id</code>	Virtual Router ID, an integer from 1 to 255.
<code>key-string</code>	Simple password string.

Example

```
ip vrrp 1 primary 192.168.66.23
```

ip vrrp override addr owner

Use the `ip vrrp override addr owner` command to accept packets addressed to the IP address(es) associated with the virtual router, such as ICMP, SNMP, and TELNET (if it is not the IP address owner). The `no` form of this command discards these packets.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip vrrp <vr-id> override addr owner
```

Parameters

`vr-id` Virtual Router ID, an integer from 1 to 255.

Example

```
X330WAN-2DS1-1(configure)# ip vrrp 1 override addr owner
```

ip vrrp preempt

Use the `ip vrrp preempt` command to configure the router to preempt a lower priority master for the virtual router ID. The `no` form of this command disables preemption for the virtual router instance. By default, preemption is enabled.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip vrrp <vr-id> preempt
```

Parameters

`vr-id` Virtual Router ID, an integer from 1 to 255.

Example

```
X330WAN-2DS1-1(configure)# ip vrrp 1 preempt
```

ip vrrp primary

Use the `ip vrrp primary` command to set the primary address that is used as the source address of VRRP packets for the virtual router ID. The `no` form of this command restores the default primary address for the virtual router instance. By default, the primary address is selected automatically by the device.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip vrrp <vr-id> primary <ip-address>
```

Parameters

<code>vr-id</code>	Virtual Router ID, an integer from 1 to 255.
<code>ip-address</code>	Primary IP address of the virtual router. This address should be one of the router addresses on the Fabric.

Example

```
ip vrrp 1 primary 192.168.66.23
```

ip vrrp priority

Use the `ip vrrp priority` command to set the virtual router priority value used when selecting a master router. The `no` form of this command restores the default value.



Note: This command is executed from the Fast Ethernet and FabricFastEthernet interfaces.

Syntax

```
[no] ip vrrp <vr-id> priority <pri-value>
```

Parameters

<code>vr-id</code>	Virtual Router ID, an integer from 1 to 255.
<code>pri-value</code>	The priority value, an integer from 1 to 254.

Example

```
X330WAN-2DS1-1(configuration)# ip vrrp 1 priority 10
```

ip vrrp timer

Use the `ip vrrp timer` command to set the virtual router advertisement timer value (in seconds) for the virtual router ID. The `no` form of this command restores the default value.

Syntax

```
[no] ip vrrp <vr-id> timer <value>
```

Parameters

`vr-id` Virtual Router ID (1-255).

`value` The advertisement transmit time (seconds). The range is from 1 to 255.

Example

To set the virtual router advertisement timer value for virtual router 3 to 2:

```
X330WAN-2DS1-1(configure)# ip vrrp 3 timer 2
```

network (Router-OSPF context)

Use the `network` command to enable OSPF in this network. The `no` form of this command disables OSPF in this network. The default is disabled.

Syntax

```
network <net addr> [<wildcard-mask> [area <area id>]]
```

Parameters

`net addr` IP address.

`wildcard-mask` Wildcard mask address.

`area id` Area ID. This parameter exists for compatibility with the P550.

Example

```
X330WAN-2DS1-1(configure router:ospf)# network 192.168.0.0  
X330WAN-2DS1-1(configure router:ospf)# network 192.168.0.0  
0.0.255.255 area 0.0.0.0
```

network (Router-RIP context)

Use the `network` command to specify a list of networks on which the RIP is running. The `no` form of this command removes an entry.

Syntax

```
[no] network <ip-address> [<wildcard-mask>]
```

Parameters

<code>ip-address</code>	The IP address of the network of directly connected networks.
<code>wildcard-mask</code>	Wildcard mask address. This parameter provides compatibility with the P550.

Example

To specify that RIP is used on all interfaces connected to the network 192.168.37.0:

```
X330WAN-2DS1-1(configure router:rip)# network 192.168.37.0
```

no ip distribution access-list

Use the `no ip distribution access-list` command to delete a distribution list statement.

Syntax

```
no ip distribution access-list <access-list-number>  
[<access-list-index>
```

Parameters

<code>access-list-number</code>	An integer from 1 to 99.
<code>access-list-index</code>	An integer.

Example

```
X330WAN-2DS1-1(configure)# no ip distribution access-list 1  
X330WAN-2DS1-1(configure)# no ip distribution access-list 2 25
```



Note: If a list index is not given in the `no ip distribution access-list` command, all rules are deleted.

ping

Use the `ping` command to check host reachability and network connectivity.

Syntax

```
ping <host> [<interval>] [<size> [timeout [source address]]]
```

Parameters

host	IP address of the target system.
interval	An integer from 1 to 256, representing the number of seconds between successive ping messages. The default is 1.
size	An integer from 22 to 65500, representing the size of the packet sent during a ping operation. The default is 50 bytes.
timeout	Timeout in seconds (1-10).
source address	IP address.

Example

```
X330WAN-2DS1-1(configure)# ping 192.168.49.1  
ping 192.168.49.1 3  
ping 192.168.49.1 3 50  
ping 192.168.49.1 3 50 2  
ping 192.168.49.1 3 50 2 192.168.49.4
```

redistribute (Router-OSPF context)

Use the `redistribute` command to redistribute routing information from other protocols into OSPF. The `no` form of this command disables redistribution by OSPF.

Syntax

```
[no] redistribute <protocol>
```

Parameters

protocol	One of the following protocols: [static connected rip].
----------	---

Example

```
X330WAN-2DS1-1(configure router:ospf)# redistribute static
```

redistribute (Router-RIP context)

Use the `redistribute` command to redistribute routing information from other protocols into RIP. The `no` form of this command disables redistribution by RIP. The default is **disabled**.

Syntax

```
[no] redistribute <protocol>
```

Parameters

`protocol` Either Static or OSPF.

Example

```
X330WAN-2DS1-1(configure router:rip)# redistribute ospf
```

router ospf

Use the `router ospf` command to enable OSPF protocol on the system and to enter the **router configuration** context. The `no` form of this command disables OSPF globally. The default is **disabled**.

Syntax

```
[no] router ospf
```

router rip

Use the `router rip` command to enable the RIP and to enter the **router configuration** context. The `no` form of this command disables RIP. The default state is **disabled**.

Syntax

```
[no] router rip
```

Example

To enable the RIP protocol:

```
X330WAN-2DS1-1(configure)# router rip
```

router vrrp

Use the `router vrrp` command to enable VRRP routing globally. The `no` form of this command disables VRRP routing.



Note: You can not activate both VRRP and SRRP protocols at the same time.

Syntax

`[no] router vrrp`

show fragment

Use the `show fragment` command to display information regarding fragmented IP packets that are destined to the router.



Note: No IP reassembly will be performed on packets in transit through the router.

This command displays the following information:

- **Size** — Maximum number of packets set by the fragment size command.
- **Chain** — Maximum number of fragments for a single packet set by the fragment chain command.
- **Timeout** — Maximum number of seconds set by the fragment timeout command.
- **Queue** — Number of packets currently awaiting reassembly.
- **Assemble** — Number of packets successfully reassembled.
- **Fail** — Number of packets which failed to be reassembled.
- **Overflow** — Number of packets which overflowed the fragment database.

Syntax

`show fragment`

Example

```
X330WAN-2DS1-1(configure)# show fragment
Max number of concurrently reassembled packets is 100
Max number of fragments per packet is 64
Fragment timeout is 10 sec
Number of packets waiting to be reassembled is 0
Number of successfully reassembled packets is 11954
Number of packets which failed to be reassembled is 0
Number of packets which overflowed the database is 0
```

show ip arp

Use the `show ip arp` command to display the Address Resolution Protocol (ARP) cache.

Syntax

```
show ip arp [<interface>|<IP interface>|<ip addr>[<ip mask>] | static]
```

Parameters

<code>interface</code>	String (up to 32 characters).
<code>IP interface</code>	String (up to 32 characters).
<code>ip addr</code>	The IP address of the station(s).
<code>ip mask</code>	The IP mask of the routes.
<code>static</code>	Display static IP ARP information.

Example

<code>show ip arp</code>	Displays all ARP mapping.
<code>show ip arp 192.168.49.1</code>	Displays one host ARP mapping.
<code>show ip arp 192.168.49.1 255.255.255.0</code>	Displays a range of ARP mapping.
<code>show ip arp "FabricFastEthernet 1:1"</code>	Displays Fabric ARP mapping.
<code>show ip arp static</code>	Displays static ARP mapping.



Note: To define a name that includes spaces, enclose the entire name in quotation marks (e.g., "New York").

show ip distribution access-lists

Use the `show ip distribution access-lists` command to display the content of all current distribution lists or of a specific list.

Syntax

```
show ip distribution access-lists [<distribution-list-number>]
```

Parameters

`distribution-list-number` The distribution list number. An integer from 1 to 99.

Example

To display the content of distribution list number 1:

```
X330WAN-2DS1-1(configure)# show ip distribution access-lists 1
```

To display the content of all current distribution lists:

```
X330WAN-2DS1-1(configure)# show ip distribution access-lists
```

show ip icmp

Use the `show ip icmp` command to display the status (enabled/disabled) of ICMP error messages.

Syntax

```
show ip icmp
```

show ip interface

Use the `show ip interface` command to display information for an IP interface.

Syntax

```
show ip interface [<interface-name>|<IP interface>|<ip-address>]
```

Parameters

<code>interface-name</code>	The name of the interface whose information you want to display.
<code>IP interface</code>	A string (up to 32 characters).
<code>ip-address</code>	The IP address of the interface whose information you want to display.



Note: To define a name that includes spaces, enclose the entire name in quotation marks (e.g., "New York").

Example

To display all IP interfaces:

```
X330WAN-2DS1-1(configure)# show ip interface
```

To display all IP interfaces on one interface:

```
X330WAN-2DS1-1(configure)# show ip interface "FastEthernet 1"
```

To display specific IP interface information:

```
X330WAN-2DS1-1(configure)# show ip interface "FastEthernet 1.0"
```

To display the IP's interface:

```
X330WAN-2DS1-1(configure)# show ip interface 192.168.49.1
```

Output Example

```
X330WAN-2DS1-1(super)# show ip interface
Showing 2 Interfaces
Serial 1:1 is down
  Internet address is 2.2.2.2          , subnet mask is 255.255.255.0
  Advertised IPCP address
  Broadcast address is 2.2.2.255
  Directed broadcast forwarding is disabled
  Proxy ARP is disabled
  Primary management IP interface

FastEthernet 1 is up
  Internet address is 149.49.75.71    , subnet mask is 255.255.255.0
  Broadcast address is 149.49.75.255
  Directed broadcast forwarding is disabled
  Proxy ARP is disabled
```

show ip interface brief

Use the `show ip interface brief` command to display a summary of the information for all of the interfaces.

Syntax

```
show ip interface brief
```

Example

```
X330WAN-2DS1-1(super)# show ip interface brief
Showing 2 Interfaces
```

Interface	Address	Mask	Status
Serial 1	20.1.1.1	24	down
FastEth	135.64.104.91	24	down

show ip ospf

Use the `show ip ospf` command to display general information about OSPF routing.

Syntax

show ip ospf

Example

```
X330WAN-2DS1-1(super)# show ip ospf
Routing Process OSPF with ID 149.49.75.71
Number of areas in this router is 1
Area 0.0.0.0
Number of Interfaces in this area 0
SPF algorithm executed 1 times
SPF hold time is 3 sec
```

show ip ospf database

Use the `show ip ospf database` command to display lists of information related to the OSPF database for a specific router.

Syntax

show ip ospf database

[{asbr-summary|router|network|network-summary|external}]

Parameters

asbr-summary	Displays information about the autonomous system boundary router summary LSAs. This parameter is optional.
router	Displays information about the router LSAs. This parameter is optional.
network	Displays information about the network LSAs. This parameter is optional.
network-summary	Displays information about the network LSAs summary. This parameter is optional.
external	Displays information about the external LSAs. This parameter is optional.

Example

```
X330WAN-2DS1-1(super router:ospf)# show ip ospf database
Showing 1 rows
Area      Type      LSA ID      Router ID      Sequence      Age      Cksm
-----  -
0.0.0.0   RTR       149.49.75.71  149.49.75.71  80000001     567     139b
```

show ip ospf interface

Use the `show ip ospf interface` command to display the OSPF-related interface information.

Syntax

```
show ip ospf interface [<interface-name>]
```

Parameters

`interface-name` A string representing the OSPF interface name.



Note: To define a name that includes spaces, enclose the entire name in quotation marks (e.g., “New York”).

Example

```
X330WAN-2DS1-1(super router: ospf)# show ip ospf interface
sh ip ospf interface
Showing 1 OSPF Interfaces
FabricFastEthernet 1:1.0 is up
Internet Address 1.1.1.1, Mask 255.255.255.0 , Area 0.0.0.0
AS Router ID 1.1.1.1, COST 1
Transmit Delay 1, State DR, Priority 1
DRId 1.1.1.1, IpAddress 1.1.1.1
BDRId is 0.0.0.0, IpAddress 0.0.0.0
Timer Intervals Configured:
Hello 10
Dead 40
Retransmit 5
Neighbor count 0
```

show ip ospf neighbor

Use the `show ip ospf neighbor` command to display OSPF neighbor information on a per-interface basis.

Syntax

```
show ip ospf neighbor
[<interface-name>] [<neighbor-id>]
```

Parameters

<code>interface-name</code>	A string representing the OSPF interface name.
<code>neighbor-id</code>	The OSPF Neighbor ID, an IP address.



Note: To define a name that includes spaces, enclose the entire name in quotation marks (e.g., “New York”).

Example

```
X330WAN-2DS1-1(super router:ospf)# show ip ospf neighbor
```

Nbr-Id	Priority	State	Router ID	Time To Live
10.0.17.2	1	2 Way	212.150.244.1	36
10.0.17.3	12	Full	10.0.17.3	38
10.0.17.6	18	Full	10.0.17.6	33
10.0.18.2	1	Full	105.1.12.1	107
10.0.20.2	0	Full	62.56.252.253	40
18.18.18.2	1	Full	62.56.255.254	38
192.168.6.173	0	Full	172.18.21.254	4

show ip protocols

Use the `show ip protocols` command to display parameters and statistics of the IP routing protocol process.

Syntax

```
show ip protocols [<protocol>]
```

Parameters

<code>protocol</code>	RIP OSPF
-----------------------	------------

Example

```
show ip protocols           Displays all running protocols details.
```

show ip protocols RIP Displays RIP details.

Output Example

```
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 0 seconds
  Invalid after 180 seconds, flushed after 300
  Redistributing: rip
  Default version control: rip version 1
    Interface                               Version   Key
  Routing for Networks:
  Routing Information Sources:
    Gateway                               Last Update
```

show ip reverse-arp

Use the `show ip reverse-arp` command to display the IP address of a host, based on a known MAC address.

Syntax

show ip reverse-arp <mac addr> [<match len>]

Parameters

`mac addr` MAC address.

`match len` The number of bytes in the address to match.

Example

show ip reverse-arp 00:40:0d:67:53:04 List IPs that match the MAC.

show ip reverse-arp 00:40:0d:00:00:00 3 List IPs that match a vendor MAC.

Output Example

```
X330WAN-2DS1-1(super)# show ip reverse-arp 00:10:a4:98:97:e0
Showing 1 rows
Address          MAC Address          I/F          Type          TTL
-----
149.49.70.68    00:10:a4:98:97:e0   e-70         Dynamic       14355
```


show ip route

Use the `show ip route` command to display information about the IP routing table.

Syntax

```
show ip route [<ip-address> [<ip-mask>]
```

Parameters

`ip-address` The IP address of the routes.

`ip-mask` The IP mask of the routes.

Example

```
show ip route                              Display all routes.
show ip route 137.32.50.13              Display a single route.
show ip route 137.44.50.13 255.255.255.0   Display a range of routes.
```

show ip route best-match

Use the `show ip route best-match` command to display a routing table for a destination address.

Syntax

```
show ip route best-match <dst addr>
```

Parameters

`dst addr` The destination IP address.

Example

```
X330WAN-2DS1-1(super)# show ip route best-match 199.93.0.0
Searching for: 199.93.0.0
Showing 1 rows
Network            Mask            Interface    Next-Hop            Cost    TTL    Source
-----
199.93.0.0        255.255.0.0    e-135new     135.64.76.1        1       n/a    STAT-HI
```

show ip route static

Use the `show ip route static` command to display the static routes.

Syntax

```
show ip route static [<ip addr> [<mask>] ]
```

Parameters

`ip-addr` The IP address of the routes.

`mask` The IP mask of the routes.

Example

```
show ip route static                      Display all static routes.
show ip route static 137.32.50.13        Display a single static route.
show ip route static 137.44.50.13 255.255.255.0 Display a range of static
routes.
```

Output Example

```
Router-1 (super)# show ip route static
X330WAN-2DS1-1(super router:ospf)# show ip route static
Showing 1 rows
Network  Mask  Interface  Next-Hop      Cost  Pref  Perm  Active
-----  -
0.0.0.0   0   FastEth 1   149.49.75.1   1    low   No    Yes
```

where `Pref` is the preference, and `Perm` is Permanent.

show ip route summary

Use the `show ip route summary` command to display the number of routes known to the device.

Syntax

```
show ip route summary
```

Example

```
X330WAN-2DS1-1(super router:ospf)# show ip route summary
X330WAN-2DS1-1(super)# show ip route summary
Route Source      Networks      Subnets
-----
Local              0              1
Static             0              1
Total              0              2
```

show ip traffic

Use the `show ip traffic` command to display IP counters information.

Syntax

show ip traffic

Output Example

IP statistics:

Received:

```
0 total, 0 local destination
0 bad hop count, 0 packet header errors
0 unknown protocol, 0 address errors
0 discarded
```

Fragments:

```
0 reassembled, 0 timeouts
0 couldn't reassemble, 0 fragmented
```

Sent:

```
0 generated, 0 forwarded
0 no route, 0 discarded
```

ICMP statistics:

Received:

```
0 total, 0 ICMP errors
0 unreachable, 0 time exceeded
0 parameter, 0 quench
0 echo, 0 echo reply
0 timestamps request, 0 timestamp reply
0 mask requests, 0 mask replies
0 redirects
```

Sent:

```
0 total, 0 ICMP errors
0 unreachable, 0 time exceeded
0 parameter, 0 quench
0 echo, 0 echo reply
0 timestamps request, 0 timestamp reply
0 mask requests, 0 mask replies
0 redirects
```

```
OSPF statistics:
  Received:
    0 total, 0 checksum errors
    0 hello, 0 database desc
    0 link state req, 0 link state updates
    0 link state acks

  Sent:
    0 total

ARP statistics:
  Received:
    0 requests, 0 replies

  Sent:
    0 requests, 0 replies (0 proxy)
```

show ip vrrp

Use the `show ip vrrp` command to display VRRP information.

Syntax

```
show ip vrrp [<vlan> [router-id <vr-id>]][detail]
```

Parameters

<code>vlan</code>	Filter by Fabric.
<code>router-id</code>	Filter by virtual router ID, an integer from 1 to 255.
<code>vr-id</code>	The virtual router ID.
<code>detail</code>	Provide detailed information.

Example

```
X330WAN-2DS1-1(configure)# show ip vrrp
```

```
VRRP is globally enabled
```

VLAN	VRID	IP Address	Pri	Timer	State	Since
1	1	192.168.66.23	255	1	MASTER	00:00:00
1	2	192.168.66.24	100	1	BACKUP	00:00:00

show ip vrrp detail

Use the `show ip vrrp detail` command to display full VRRP-related information.

Syntax

```
show ip vrrp detail
```

Output Example

```
X330WAN-2DS1-1(configure)# show ip vrrp detail
VRRP is globally enabled
Virtual Router on VLAN: 1
  Router-id: 1
  State: MASTER
  Priority: 255
  Advertisement Interval: 1
  Last State Change: 00:00:00
  Override Address Ownership Rule: No
  Authentication Type: None
  Authentication Key: ""
  Master IP Address 192.168.66.23
  Has 1 IP addresses
  IP addresses:
    192.168.66.23
  Primary IP Address: 192.168.66.23
  Primary IP Address was chosen by default
  Preemption Mode: enabled
  # of times Master: 2
  # of received Advertisements: 0
  # of transmitted Advertisements: 20
  # of received Advertisements with Security Violations: 0
Virtual Router on VLAN: 1
  Router-id: 2
  State: BACKUP
  Priority: 100
  Advertisement Interval: 1
  Last State Change: 00:00:00
  Override Address Ownership Rule: No
  Authentication Type: None
  Authentication Key: ""
  Master IP Address 0.0.0.0
  Has 1 IP addresses
  IP addresses:
```

```
192.168.66.24
Primary IP Address:      192.168.66.23
Primary IP Address was chosen by default
Preemption Mode:       enabled
# of times Master:      1
# of received Advertisements: 0
# of transmitted Advertisements: 13
# of received Advertisements with Security Violations: 0
```

timers basic (Router-RIP context)

Use the `timers basic` command to set RIP timers. The `no` form of this command sets the RIP timers to their default values.

Syntax

```
[no] timers basic <update> <invalid>
```

Parameters

`update` RIP update timer, in seconds (minimum 30).
`invalid` RIP invalid route timer, in seconds (minimum 30).

Example

```
X330WAN-2DS1-1(configure router:rip)# timers basic 30 180
```

timers spf (Router-OSPF context)

Use the `timers spf` command to configure the delay between runs of OSPF's SPF calculation. The `no` form of this command restores the default value, 3 seconds.

Syntax

```
[no] timers spf <spf-holdtime>
```

Parameters

`spf-holdtime` The time in seconds of the delay between runs of OSPF's SPF calculation. The range of acceptable values is 1 to 3600.

Example

```
X330WAN-2DS1-1(super)# timers spf 5
```

traceroute

Use the `traceroute` command as a trace route utility.

Syntax

traceroute <host>

Parameters

host The IP address.

Example

```
X330WAN-2DS1-1 (super) # traceroute 192.168.50.13
```

Policy CLI Commands

This section contains a list of all Policy-related CLI commands.

ip access-default-action

Use the `ip access-default-action` command to set the default action for a specific Policy list.

Syntax

ip access-default-action <policy-list-number> <default-action>

Parameters

policy-list-number An integer from 100 to 149, where 0 is the default list.
default-action default-action-deny | default-action-permit

Example

```
X330WAN-2DS1-1 (super) # ip access-default-action 101 default-action-deny
```

ip access-group (Interface context)

Use the `ip access-group` command to activate a specific Policy list and direction. The `no` form of this command suspends the Policy list.

Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
[no] ip access-group <policy-list-number> <direction>
```

Parameters

policy-list-number	An integer from 100 to 149, where 0 is the default list.
direction	in out

Example

```
X330WAN-2DS1-1(config-if:FastEthernet1)# ip access-group 110 out
```

ip access-list

Use the `ip access-list` command to create a specific Policy rule. Each rule pertains to the source IP address, the destination IP address, the protocol, the protocol ports (TCP/UDP, if relevant), and to the ACK bit (in TCP protocol). The `no` form of this command deletes a specific rule.

The syntax for this command is:

```
[no] ip access-list <policy-list-number> <access-list-index> <action>  
<protocol> {<source-ip> <source-wildcard>|any|host <source-ip>}  
[<operator> <port> [<port>]] {<destination-ip> <destination-  
wildcard>|any|host <destination-ip>} [<operator> <port>  
 [<port>]] [established] [precedence]
```

Parameters

policy-list-number	An integer from 100 to 149.
access-list-index	An integer from 100 to 149.
action	permit deny deny-and-notify fwd0-7 composite op name
protocol	ip tcp udp integer from 1 to 255.
source-ip	IP network
source-wildcard	IP network wildcard
operator	eq lt gt range
port	An integer from 1 to 65535.
destination-ip	IP network
destination-wildcard	IP network wildcard

precedence mandatory|optional

Example

```
X330WAN-2DS1-1(super)# ip access-list 101 23 deny ip any 1.2.0.0
0.0.255.255
X330WAN-2DS1-1(super)# ip access-list 101 23 deny ip any 10.10.0.0
0.0.255.255
X330WAN-2DS1-1(super)# ip access-list 101 24 fwd3 udp any host
10.1.1.1 range 20 23 optional
X330WAN-2DS1-1(super)# ip access-list 101 25 permit tcp any any eq 23
established
```

ip access-list-cookie

Use the `ip access-list-cookie` command to set the list cookie for a specific Policy list.

Syntax

```
ip access-list-cookie <list-id> <cookie>
```

Parameters

`list-id` An integer from 100 to 149, where 0 is the default list.

`cookie` An integer.

Example

```
X330WAN-2DS1-1(super)# ip access-list-cookie 101 12345
```

ip access-list-copy

Use the `ip access-list-copy` command to copy a configured source Policy list to a destination Policy list.

Syntax

```
ip access-list-copy <source-list> <destination-list>
```

Parameters

`source-list` An integer from 100 to 149, where 0 is the default list.

`destination-list` An integer from 100 to 149.

Example

```
X330WAN-2DS1-1(super)# ip access-list-copy 100 101
```

ip access-list-dscp name

Use the `ip access-list-dscp name` command to set a DSCP name.

Syntax

```
ip access-list-dscp name <policy-list-number> <dscp> <name>
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>dscp</code>	DSCP entry (0-63).
<code>name</code>	Entry name.

Example

```
X330WAN-2DS1-1 (super) # ip access-list-dscp name 101 16 "special"
```

ip access-list-dscp operation

Use the `ip access-list-dscp operation` command to set a DSCP into action.

Syntax

```
ip access-list-dscp operation <policy-list-number> <dscp> <action>
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>dscp</code>	Range of DSCP.
<code>action</code>	Action name.

Example

```
X330WAN-2DS1-1 (super) # ip access-list-dscp operation 101 9-16 fwd3
```

ip access-list-dscp precedence

Use the `ip access-list-dscp precedence` command to set a DSCP precedence.

Syntax

```
ip access-list-dscp precedence <policy-list-number> <dscp>  
<precedence>
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>dscp</code>	DSCP entry, from 0 to 63.
<code>precedence</code>	mandatory optional

Example

```
X330WAN-2DS1-1(super)# ip access-list-dscp precedence 101 16
mandatory
```

ip access-list-dscp trust

Use the `ip access-list-dscp trust` command to set a DSCP trust.

Syntax

```
ip access-list-dscp trust <policy-list-number> {untrusted | trust-cos
| trust-dscp | trust-cos-dscp}
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149. 0 is the default list.
---------------------------------	--



Note: To return to the default value, enter this command with `trust-cos` option.

Example

```
X330WAN-2DS1-1(super)# ip access-list-dscp trust 101 trust-dscp
```

ip access-list-name

Use the `ip access-list-name` command to set a name for a Policy list.

Syntax

```
ip access-list-name <policy-list-number> <name>
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>name</code>	List name.

Example

```
X330WAN-2DS1-1(super)# ip access-list-name 101 morning
```



Note: To define a name that includes spaces, enclose the entire name in quotation marks (e.g., “New York”).

ip access-list-owner

Use the `ip access-list-owner` command to set the owner for a specific Policy list.

Syntax

```
ip access-list-owner <policy-list-number> <owner>
```

Parameters

`policy-list-number` An integer from 100 to 149, where 0 is the default list.

`owner` List owner.

Example

```
X330WAN-2DS1-1(super)# ip access-list-owner 101 admin
```

ip composite-op access

Use the `ip composite-op access` command to set the access value of a Policy operation.

Syntax

```
ip composite-op access <policy-list-number> <composite-operation-index> <access>
```

Parameters

`policy-list-number` An integer from 100 to 149, where 0 is the default list.

`composite-operation-index` Index of operation in the table.

`access` forward | deny

Example

```
X330WAN-2DS1-1(configure)# ip composite-op access 101 17 forward
```

ip composite-op dscp

Use the `ip composite-op dscp` command to set the DSCP value of a Policy operation.

Syntax

```
ip composite-op dscp <policy-list-number> <composite-op-index> <dscp value>
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>composite-op-index</code>	Index of operation in the table.
<code>dscp value</code>	DSCP entry, an integer from 0 to 63. 64 signifies no change.

Example

```
X330WAN-2DS1-1(configure)# ip composite-op dscp 101 17 52
```

ip composite-op name

Use the `ip composite-op name` command to set the name of a Policy operation.

Syntax

```
ip composite-op name <policy-list-number> <composite-op-index>  
<OpName>
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>composite-op-index</code>	Index of operation in the table.
<code>OpName</code>	The name of the Policy operation.

Example

```
X330WAN-2DS1-1(configure)# ip composite-op name 101 17 gold-account
```

ip composite-op notify

Use the `ip composite-op notify` command to set the trap mode of a composite operation in a Policy list.

Syntax

```
ip composite-op notify <policy-list-number> <composite-operation-index> <notify>
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>composite-operation-index</code>	Index of operation in the table.
<code>notify</code>	<code>send-trap</code> <code>no-trap</code>

Example

```
X330WAN-2DS1-1(configure)# ip composite-op notify 101 17 send-trap
```

ip composite-op priority

Use the `ip composite-op priority` command to set the Layer 2 priority of a Policy operation.

Syntax

```
ip composite-op priority <list-number> <composite-op-index>  
<priority>
```

Parameters

<code>list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>composite-op-index</code>	Index of operation in the table.
<code>priority</code>	<code> fwd0-7</code> <code>no-change</code>

Example

```
X330WAN-2DS1-1(configure)# ip composite-op priority 101 17 fwd1  
X330WAN-2DS1-1(configure)# ip composite-op name 101 17 gold-account
```

ip simulate (Interface context)

Use the `ip simulate` command to check the Policy for a simulated packet. The command contains the addressed list number and the packet parameters.

Note: This command is executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces.

Syntax

```
ip simulate <policy-list-number> <direction> [<priority>]
[<dscp-value>]<source> <destination> [<protocol> [<source
port> <destination port> [<established>]]]
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>direction</code>	<code>in out</code>
<code>priority</code>	<code> fwd0 fwd1 .. fwd7</code>
<code>dscp value</code>	<code> dscp0 dscp1 .. dscp63</code>
<code>source</code>	Source IP address.
<code>destination</code>	Destination IP address.
<code>protocol</code>	<code> ip tcp udp integer from 1 to 255.</code>
<code>source port</code>	An integer from 1 to 65535.
<code>destination port</code>	An integer from 1 to 65535.
<code>established</code>	Value of TCP established bit.

Example

```
X330WAN-2DS1-1(config-if:FastEthernet1)# ip simulate 100 in
192.67.85.12 193.76.54.25
```

no ip composite-op

Use the `no ip composite-op` command to delete a composite operation from a Policy list.

Syntax

```
no ip composite-op monitor <policy-list-number> <composite-operation-index>
```

Parameters

<code>policy-list-number</code>	An integer from 100 to 149. 0 is the default list.
<code>composite-operation-index</code>	Index of operation in the table to be deleted. Indices 0 - 12 can not be deleted.

Example

```
X330WAN-2DS1-1(configure)# no ip composite-op 101 15
```

set qos policy-source

Use the `set qos policy-source` command to set the Policy source. The default Policy source is `policy-server`.



Note: Before configuring the IP access list, you must change the Policy source mode to `local`.

Syntax

```
set qos policy-source <source>
```

Parameters

<code>source</code>	<code>local</code> <code>policy-server</code>
---------------------	---

Example

```
X330WAN-2DS1-1(configure)# set qos policy-source local
```

show ip access-group

Use the `show ip access-group` command to display information about the configured active access groups.

Syntax

```
show ip access-group <interface name> [<directions>]
```


Parameters

interface name	The name of the interface, a string (e.g., "FastEthernet 0").
directions	in out

Example

```
X330WAN-2DS1-1(configure)# show ip access-group "FastEthernet 1" in
```



Note: This command is available only when not in any context.

show ip access-list-dscp

Use the `show ip access-list-dscp` command to display the DSCP table of a given Policy list.

Syntax

```
show ip access-list dscp <policy-list-number> [<dscp>]
```

Parameters

policy-list-number	The Policy list number, an integer from 100 to 149, where 0 is the default list.
dscp	DSCP entry, an integer from 0 to 63.

Example

```
X330WAN-2DS1-1(configure)# show ip access-list-dscp 101 63
```

show ip access-lists

Use the `show ip access-lists` command to see all the current Policy lists.

Syntax

```
show ip access-lists [<policy-list-number>]
```

Parameters

policy-list-number	The Policy list number, an integer from 100 to 149, where 0 is the default list.
--------------------	--

Example

```
X330WAN-2DS1-1(configure)# show ip access-lists
ip access-list 100 10 deny-and-notify tcp
```

```
192.168.55.0      0.0.0.255      range 5000 6000
any range 7000 8000
ip access-list 100 30 deny udp
any
any
optional
ip access-list 100 35 deny ip
any
any
ip access-list 100 55 fwd7 tcp
host 192.168.3.4      eq 33333
host 10.6.7.8
default action for list 100 is permit
```

show ip access-lists details

Use the `show ip access-lists details` command to display all information about an active Policy list, including DSCP and composite operation tables.

Syntax

```
show ip access-lists details <interface-name>[<list-  
number><direction>]
```

Parameters

interface-name	A string (e.g., "FastEthernet 1").
list-number	An integer from 100 to 149, where 0 is the default list.
direction	in out

Example

```
X330WAN-2USP-1(super) # show ip access-lists details "FastEthernet 1"  
101 in
```

show ip access-list-summary

Use the `show ip access-list-summary` command to display the Policy list summary.

Syntax

```
show ip access-list-summary
```

show ip active-access-groups

Use the `show ip active-access-groups` command to display all activated lists on all interfaces.

Syntax

show ip active-access-groups

show ip composite-op

Use the `show ip composite-op` command to show a composite operation of a Policy list.

Syntax

show ip composite-op [<policy-list-number>] [<composite-operation-index>]

Parameters

<code>policy-list-number</code>	The Policy list number, an integer from 100 to 149, where 0 is the default list.
<code>composite-operation-index</code>	Index of the operation in the table.

Example

```
X330WAN-2DS1-1(configure)# show ip composite-op 101 11
```

validate-group (Interface context)

Use the `validate-group` command to verify that all the rules in a priority list are valid.



Note: This command can only be executed from the Serial, Loopback, Fast Ethernet, and FabricFastEthernet interfaces of the X330WAN.

Syntax

validate-group <policy-list-number> <direction> [quiet]

Parameters

<code>policy-list-number</code>	An integer from 100 to 149, where 0 is the default list.
<code>direction</code>	<code>in out</code>
<code>quiet</code>	Error messages not displayed.

Example

```
X330WAN-2DS1-1(config-if:Serial1:1)# validate-group 101 in
```

Interface Specifications

This appendix provides pinout information for the following cables:

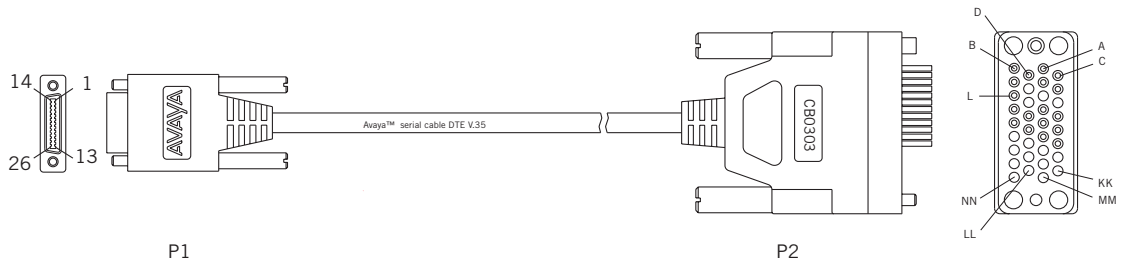
- DTE V.35 cable
- DTE X.21 cable
- Console interface - RJ-45 to DB-9 and DB-25 cable

DTE V.35

Introduction

Figure A.1 shows the serial to V.35 cable and Table A.1 shows the DCE pinouts. The arrows indicate the signal direction – --> means DTE to DCE and <-- means DCE to DTE.

Figure A.1 Avaya™ serial cable DTE V.35



Pinouts

Table A.1 V.35 DCE Serial Cable Pinouts

Serial connector pin	Signal name	Note	Direction	V.35 pin
P1-22 P1-23	MODE1 MODE0	Local connections		
P1-21	MODE2	Not connected		
Drain wire		Shield GND	---	P2-A

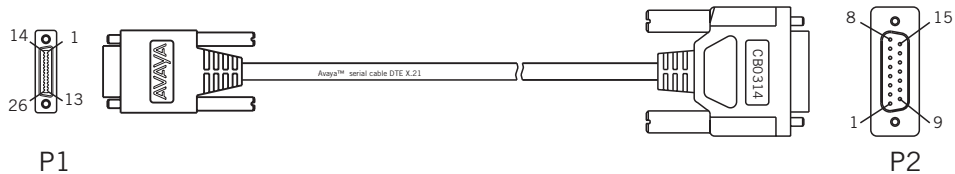
Serial connector pin	Signal name	Note	Direction	V.35 pin
P1-24	DCE/DTE _n	Local connections		
P1-8 P1-7	RTS+ DTR+	Twisted pair #4	--> -->	P2-C P2-H
P1-11 P1-12	CTS+ DSR+	Twisted pair #2	<-- <--	P2-D P2-E
P1-6 P1-19	DCD- GND	Twisted pair #1	<-- ---	P2-F
P1-13 P1-26	LL GND	Twisted pair #3	--> ---	P2-L P2-B
P1-1 P1-14	TXD+ TXD-	Twisted pair #5	--> -->	P2-P P2-S
P1-5 P1-18	RXD+ RXD-	Twisted pair #9	<-- <--	P2-R P2-T
P1-2 P1-15	SCTE+ SCTE-	Twisted pair #6	--> -->	P2-U P2-W
P1-4 P1-17	RXC+ RXC-	Twisted pair #8	<-- <--	P2-V P2-X
P1-3 P1-16	TXC+ TCX-	Twisted pair #7	<-- <--	P2-Y P2-AA

DTE X.21

Introduction

Figure A.2 shows the Avaya serial to X.21 cable and Table A.2 shows the pinouts. The arrows indicate the signal direction – --> means DTE to DCE and <-- means DCE to DTE.

Figure A.2 Avaya™ serial cable DTE X.21 Cable



Pinouts

Table A.2 X.21 DCE Serial Cable Pinouts

Serial connector pin	Signal name	Note	Direction	DB-15 connector pin
Drain wire		Shield GND		P2-1
P1-1 P1-14	TXD+ TXD-	Twisted pair #5	--> -->	P2-2 P2-9
P1-8 P1-9	RTS+ RTS-	Twisted pair #3	--> -->	P2-3 P2-10
P1-5 P1-18	RXD+ RXD--	Twisted pair #8	<-- <--	P2-4 P2-11
P1-11 P1-10	CTS+ CTS-	Twisted pair #2	<-- <--	P2-5 P2-12
P1-4 P1-17	RXC+ RXC-	Twisted pair #7	<-- <--	P2-6 P2-13
		Not connected		P2-14 P2-15 P2-7
P1-22 P1-23		Not connected		

Serial connector pin	Signal name	Note	Direction	DB-15 connector pin
P1-21 P1-24	MODE<2> DCE/DTE _n	Local connections	--- ---	
P1-26	GND	Twisted pair #1	---	8
Not used		Twisted pair #4		Not used
Not used		Twisted pair #6		Not used
Not used		Twisted pair #9		Not used

Console Pin Assignments

Table A.3 shows the pinout from the X330WAN RJ-45 connector to both a DB-9 and DB-25 connector.

Table A.3 Pinout for Console Communications

X330WAN RJ-45 Pin	Name	Terminal DB-9 Pin	Modem DB-25 Pin
1	For future use	NC	See note
2	TXD (P330 input)	3	3
3	RXD (P330 output)	2	2
4	CD	4	8
5	GND	5	7
6	DTR	1	20
7	RTS	8	4
8	CTS	7	5



Note: Pin 1 of the Modem DB-25 connector is internally connected to Pin 7 GND.

Embedded Web Manager

The Embedded Web Manager for X330WAN provides the following:

- Expansion module configuration.
- E1/T1/USP port configuration.
- Channel group management.
- Channel group wizard.
- Routing configuration.
- Backup interfaces configuration.
- Frame Relay parameters configuration.

System Requirements

Minimum hardware and Operating System requirements are:

- One of the following operating systems:
 - Windows 95
 - Windows 98 SP1
 - Windows 98 OSR (Second Edition)
 - Windows ME
 - Windows NT Workstation or Server
 - Windows 2000 Professional or Server
- Pentium® II 400 MHz-based computer with 256 Mb of RAM (512 Mb recommended).
- Minimum screen resolution of 1024 x 768 pixels.
- Sun Microsystems Java™ plug-in version 1.3.1_02 (supplied).
- Microsoft Internet Explorer or Netscape Navigator/Communicator (see table).

	Windows 95 or NT	Windows 98, ME, or 2000
Internet Explorer	5.0 or higher	5.01 or higher
Netscape Navigator/Communicator	4.7	4.73



Note: The Java plug-in requires certain services from Windows 95 which are not present if Internet Explorer is not installed. In order to add these services to the operating system, install Internet Explorer version 3 or higher. You can then use either browser to manage the switch.

Running the Embedded Manager



Note: Assign a PMI (Primary Management Interface) on X330WAN and ensure that a route is available between the management station and the PMI before beginning this procedure. For more information on PMIs, refer to the description on page 34.

- 1 Open your browser.
 - 2 Enter the URL of the switch in the format **http://aaa.bbb.ccc.ddd** where **aaa.bbb.ccc.ddd** is the IP address of the master agent of the P330 stack.
-



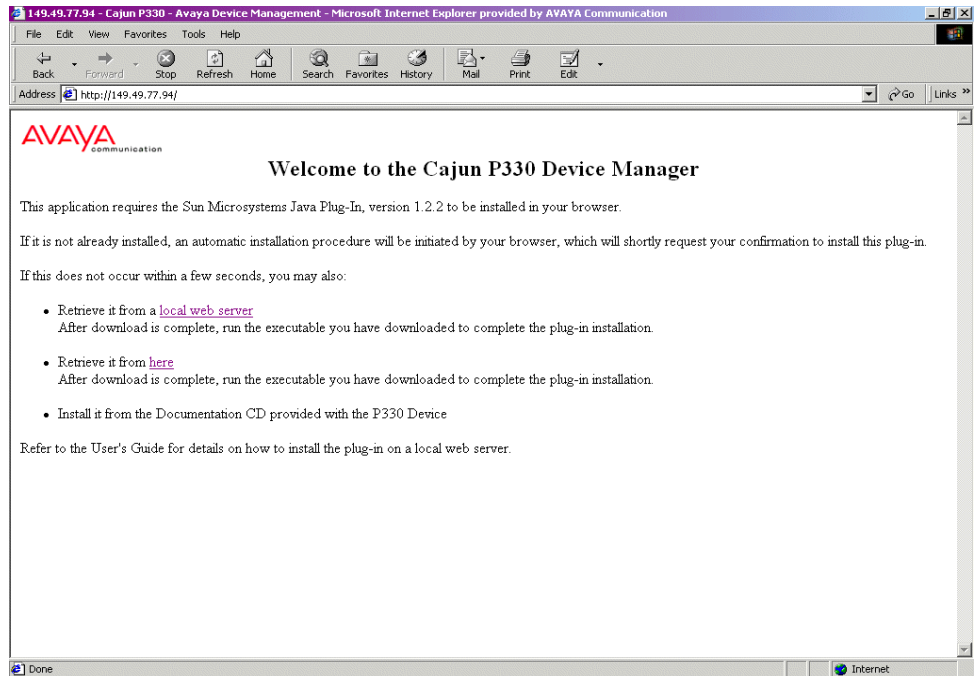
Note: The default user name is **root**
The default password for read-write access is **root**.



Note: The Web management passwords are the same as those of the CLI. If you have created additional CLI user names or changed the default passwords, you can use those passwords for Web management also.

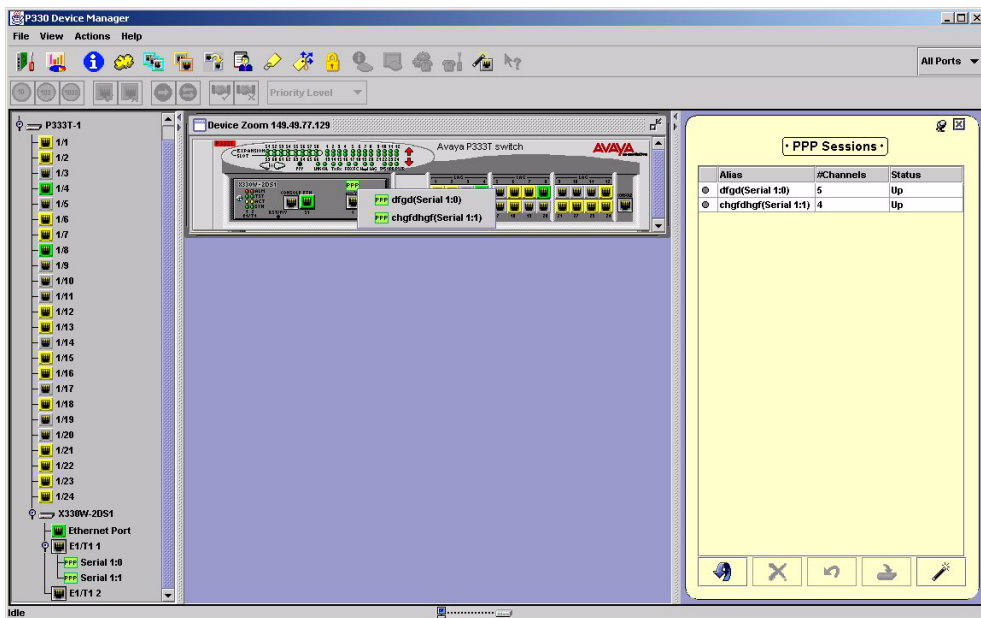
The Welcome page is displayed, as shown in Figure B.1.

Figure B.1 The Welcome Page



- If you have the Java plug-in installed, the Web-based manager opens in a new window, as shown in Figure B.2.

Figure B.2 Web-based Manager



- If you do not have the Java plug-in installed, follow the instructions on the Welcome page, shown in Figure B.1, that provide several options for installing the plug-in, or see "Installing the Java Plug-in" on page 230.

Installing the Java Plug-in

If your system administrator has configured the system, the plug-in should already be installed.



Note: Ensure that Java or JavaScript is enabled on your Web browser. Refer to your browser on-line help or documentation for further information.

If the plug-in is not already installed, choose one of the following options for installing the plug-in. Each option is described in the following sections.

- Installing from the Avaya P330 Documentation and Utilities CD.
- Installing from the Avaya Site.
- Installing from your Local Web Site.

Installing from the Avaya P330 Documentation and Utilities CD

To install the Java plug-in from the CD:

- 1 Close all unnecessary applications on your PC.
- 2 Insert the “Avaya P330 Documentation and Utilities” CD into the CD drive.
- 3 Click **Start** on the task bar.
- 4 Click **Run**.
- 5 Type **x:\emweb-aux-files\plug-in_1_3_1_02.exe** where **x** is the CD drive letter.
- 6 Follow the instructions on the screen.

Installing from the Avaya Site

To install the Java plug-in from the Avaya web site, click the appropriate link in the Welcome page, shown in Figure B.1.

Installing from your Local Web Site

To install the Java plug-in from your local web site, click the appropriate link in the Welcome page, shown in Figure B.1.



Note: This option is only available if your system administrator has placed the files on the local Web server.

Installing the On-Line Help and Java Plug-In on your Web Site



Note: This procedure is optional.

Copying the help files and Java plug-in to a local Web server allows you to access the on-line help for the Embedded Manager and enables automatic installation of the Java plug-in the first time you try to manage the device.

- 1 Copy the `emweb-aux-files` directory from the “Avaya P330 Documentation and Utilities” CD to your local Web server. Refer to your Web server documentation for full instructions.
- 2 Define the URL in the Avaya P330 using the following command:
set web aux-files-url <>//IP address/directory name>
where <>//IP address/directory name> is the location of the directory from the previous step.

Documentation and Online Help

Refer to the Avaya P330 Documentation and Utilities CD.

Software Download

You can perform software download using the CLI or Avaya UpdateMaster.

Standards and Compliance

This appendix provides information about the X330WAN's standards compliance, and includes the following sections:

- ANSI Standards Compliance
- ITU-T Standards Compliance
- RFC Standards Compliance
- NEBS Standards Compliance
- Type Approval Standards (Safety, EMC, and Telco)

ANSI Standards Compliance

X330WAN complies with the following ANSI standards:

ANSI #	Description
T1.231	T1
T1.403	T1

ITU-T Standards Compliance

X330WAN complies with the following ITU-T standards:

ITU-T #	Description
G.703	E1
G.704	E1

RFC Standards Compliance

X330WAN complies with the following RFC standards:

RFC #	Description
791	Internet Protocol Datagram Reassembly Algorithms
792	Internet Control Message Protocol (ICMP)
826	Ethernet Address Resolution Protocol (ARP)
894	Standard for the transmission of IP datagrams over Ethernet
951	Bootstrap Protocol
1058	Routing Information Protocol (RIP)
1213	MIB-II, System Group IP MIB, SNMP, TCP, UDP, ICMP
1215	Defining Traps for use with the SNMP
1471	Definitions of Managed Objects for the IP Network Control Protocol of the Point-to-Point Protocol
1473	Definitions of Managed Objects for the IP Network Control Protocol for the Point-to-Point Protocol
1533	DHCP Options and BOOTP Vendor Extensions
1534	Interoperation Between DHCP and BOOTP
1541	Dynamic Host Configuration Protocol (DHCP)
1542	Clarifications and Extensions for the Bootstrap Protocol
1724	RIP2
1757	Monitoring and Statistics
1812	IPv4
1850	OSPF Version 2 Management Information Base
1858	Security Considerations for IP Fragment Filtering
2096	ipCidRoute Table
2338	VRRP

RFC #	Description
2494	Definitions of Managed Objects for the DS0 and DS0 Bundle Interface Type
2495	Definitions of Managed Objects for the DS1, E1, DS2, and E2 Interface Types
2508	Compressing IP/UDP/RTP Headers for Low-Speed Serial Links
2863	The Interfaces Group MIB
3128	Protection Against a Variant of the Tiny Fragment Attack

NEBS Standards Compliance

X330WAN complies with the following NEBS standards:

Certification	Description
NEBS level 3	USA Electrical and Physical.

Type Approval Standards

X330WAN has undergone all required regulatory compliance test procedures (EMC, Telco, Safety) for Type Approval in the following countries:

- USA
- Canada
- European Union
- China
- South Korea
- Brazil
- Mexico

This product complies with and conforms to the standards presented below, as applicable.

Safety Standards Compliance

X330WAN complies with the following safety standards:

Certification	Description
CE	Europe
EN60950	Western Europe Amendments A1,A2,A3 - Effective now. Amendments A4,A11 - Effective August 1st 2003.
UL60950	
Global IEC, CB Schema report IEC 950	IEC 950 with country deviations for: EU, Japan, South Korea, Brazil, and China.
NOM 16 and 19	Mexico

Electromagnetic Standards Compliance (EMC)

X330WAN complies with the following EMC standards:

Certification	Description
FCC Part 15, Class A and Class B	USA Outdoors. Note: Class B compliance is obtained with one X330WAN module in a stack of P330 switches. More than one expansion module per stack might cause deviation from Class B compliance.
IECS 003, Class B	Canada.
EN55022(1998) Class B Based on CISPR 22.	Europe. Radiation and Conducted Emissions. Note: P330 switches are certified as Class A.

Certification	Description
EN55024 Based on CISPR 24.	Europe. Immunity Characteristics. Includes: <ul style="list-style-type: none"> • IEC61000-4-2 - Electrostatic discharge • IEC61000-4-3 - Radiated immunity • IEC61000-4-4 - Fast transient • IEC61000-4-5 - Surge immunity • IEC61000-4-6 - Immunity to conducted disturbances • IEC61000-4-8 - Power frequency magnetic field immunity • IEC61000-4-11 - Voltage dips.
EN61000-3-2	Power supply - harmonic current.
EN61000-3-3	Power supply - flicker.
VCCI Class B	Japan.

Telecommunication Standards Compliance

X330WAN complies with the following Network standards:

Certification	Description
FCC Part 68	USA. Protection of telephone networks from harm caused by terminal equipment/wiring.
CS03	Industry Canada. Similar to FCC Part 68.
TBR12	Europe. Unstructured 2048 Kbps digital leased line - terminal equipment requirements.
TBR13	Europe. Structured 2048 Kbps digital leased line - terminal equipment requirements.

How to Contact Us

To contact Avaya's technical support, please call:

In the United States

Dial 1-800-237-0016, press 0, then press 73300.

In the EMEA (Europe, Middle East, and Africa) Region

Country	Local Dial-In Number
Albania	+31 70 414 8001
Austria	+43 1 36 0277 1000
Azerbaijan	+31 70 414 8047
Bahrain	+800 610
Belgium	+32 2 626 8420
Belorussia	+31 70 414 8047
Bosnia Herzegovina	+31 70 414 8042
Bulgaria	+31 70 414 8004
Croatia	+31 70 414 8039
Cyprus	+31 70 414 8005
Czech Rep.	+31 70 414 8006
Denmark	+45 8233 2807
Egypt	+31 70 414 8008
Estonia	+372 6604736
Finland	+358 981 710 081

Country	Local Dial-In Number
France	+33 1 4993 9009
Germany	+49 69 95307 680
Ghana	+31 70 414 8044
Gibraltar	+31 70 414 8013
Greece	+00800 3122 1288
Hungary	+06800 13839
Iceland	+0800 8125
Ireland	+353 160 58 479
Israel	+1 800 93 00 900
Italy	+39 02 7541 9636
Jordan	+31 70 414 8045
Kazakhstan	+31 70 414 8020
Kenya	+31 70 414 8049
Kuwait	+31 70 414 8052
Latvia	+371 721 4368

Country	Local Dial-In Number
Lebanon	+31 70 414 8053
Lithuania	+370 2 756 800
Luxemburg	+352 29 6969 5624
Macedonia	+31 70 414 8041
Malta	+31 70 414 8022
Mauritius	+31 70 414 8054
Morocco	+31 70 414 8055
Netherlands	+31 70 414 8023
Nigeria	+31 70 414 8056
Norway	+47 235 001 00
Oman	+31 70 414 8057
Pakistan	+31 70 414 8058
Poland	+0800 311 1273
Portugal	+351 21 318 0047
Qatar	+31 70 414 8059
Romania	+31 70 414 8027
Russia	+7 095 733 9055
Saudi Arabia	+31 70 414 8022

Country	Local Dial-In Number
Slovakia	+31 70 414 8066
Slovenia	+31 70 414 8040
South Africa	+0800 995 059
Spain	+34 91 375 3023
Sweden	+46 851 992 080
Switzerland	+41 22 827 8741
Tanzania	+31 70 414 8060
Tunisia	+31 70 414 8069
Turkey	+800 4491 3919
UAE	+31 70 414 8036
Uganda	+31 70 414 8061
UK	+44 0207 5195000
Ukraine	+31 70 414 8035
Uzbekistan	+31 70 414 8046
Yemen	+31 70 414 8062
Yugoslavia	+31 70 414 8038
Zimbabwe	+31 70 414 8063

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Country	Local Dial-In Number
Australia	+1800 255 233
Hong Kong	+2506 5451
Indonesia	+800 1 255 227
Japan	+0 120 766 227
Korea	+0 80 766 2580

Country	Local Dial-In Number
Malaysia	+1800 880 227
New Zealand	+00 800 9828 9828
Philippines	+1800 1888 7798
Singapore	+1800 872 8717
Taiwan	+0 80 025 227

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For updated contact information, visit:

www.avaya.com/directories/global_escalation_list.html.

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